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NOTES AND COMMENTS.

Reminiscences of Huxley.

IN *Scribner's Magazine* for October, Mr. George W. Smalley writes a pleasant and intimate paper on Huxley. During the many years Mr. Smalley represented a great American newspaper in London, he became acquainted with nearly all our latter-day celebrities, and he was a private friend of Huxley's for years. Since some may be ignorant of the marvellous extent to which Huxley was well-informed upon every subject he discussed, we quote a striking instance—one of many—from Mr. Smalley. "When he set forth in his trenchant way some of the absurdities of Auguste Comte, Mr. Frederic Harrison, one of the high priests of positivism in England, replied that Mr. Huxley had evidently never read Comte. Huxley took the trouble to explain that he had early mastered the six volumes of the 'Philosophie Positive,' and had re-read them for the purposes of that discussion."

The combative side of Huxley's character is at least sufficiently well-known to everyone. A great part of his life was spent in fighting; but it was in fighting for science and for freedom of thought. The gentler side of his nature impressed itself on Mr. Smalley. "At his own table he avoided arguments when he could. Others, or all others, did not. Mr. Huxley sat there with a serenity and patience which were admirable, joining in discussions in a way to mitigate their severity; he himself, too, of a nature to avoid all compromise, but keeping under the purely intellectual view, and reviving the social view, when too eager disputants seemed in danger of taking some other."

Huxley was devoted to cats. "Like all men of gentle mind, Mr. Huxley liked this gentle race; liked their coaxing ways, their intelligence, their unlikeness to that human kind with which they have, nevertheless, a sympathy so strong, when the human sympathy and intelligence are equal to theirs. One or other of his cats was

always with him. He was never too busy to give them the recognition they sought, and their friendship was one of the things he valued."

It is plain enough, from the work that he accomplished, that Huxley was untiring in his industry. Mr. Smalley testifies:—"He never spared himself. Often and often have I known him leave the circle of family and friends, of which he was the life, very early in the evening and betake himself to his library; a room of which the only luxury was books. If remonstrated with, or appealed to for another half-hour, he would only shake his head. There was something to be done. And it would be midnight or one or two o'clock before it was done, and then he was up at seven in the morning. I sometimes thought he had no higher happiness than work; perhaps nobody has. He would dine on a little soup and a bit of fish; more than that was a clog on his mind. 'The great secret,' he said, 'is to preserve the power of working continuously sixteen hours a day if need be. If you cannot do that you may be caught out any time'."

Sir William Flower upon Huxley.

The Director of the Natural History Museum contributes to the September number of the *North American Review* an interesting series of personal reminiscences of Huxley. He reminds his readers that Huxley was not in early life "what is commonly called a naturalist." "His early tastes were for literature and engineering," and he displayed no boyish love for the formation of collections. Sir W. Flower thinks that most men who have distinguished themselves in zoology or palæontology were specimen-hunters in their boyhood. Darwin, of course, is the first instance that rises in the mind; but every biologist knows personally many others. We are disposed to think, however, that a considerable and increasing number of biologists do not begin as school-boy naturalists. The inquiry would be so interesting that we wish some person of leisure would send a circular to every biologist in Europe and tabulate the answers to the questions:

1. Have you ever made collections?
2. If so, of what?
3. If not, how came you to devote yourself to biological work?

We think that there can be no doubt that every zoologist (and we include palæontologists in the term) ought to have studied species at some period of his career.

Another interesting point referred to by Sir William Flower is Huxley's treatment of "specimens." In this matter there are two kinds of consciences, and it is a grim struggle when it comes to a battle between them. There is the museum conscience, to which the violation of a rare or perfect specimen by scalpel and scissors is the sin not to be forgiven. There is the anatomical conscience, to which shutting up in a glass bottle a rare specimen, instead of dissecting it, seems a miserly stupidity. Of course, the easy solution is when there are more specimens than one. But when there is only one, is it to be

dissected or catalogued? There is no absolute answer. The museum man or the anatomist must act according to his lights—and beware of the other. Huxley was frankly anatomical. "He cared for a specimen according to the facilities it afforded for investigation. He cut it up, got all the knowledge he could out of it, and threw it away."

Pasteur.

In another place in this issue we publish notices of Pasteur's chemical work and of the clinical results obtained from his investigations into microbes. It is exceedingly difficult, in the case of a subject in which so many investigators have made almost simultaneous discoveries, to assign to each his due share of praise. We are disposed to think, however, that Dr. Andrewes, in his endeavour to be strictly impartial, has assigned to Pasteur's influence rather less than he might have done with propriety. We do not think it possible to over-estimate the value of Pasteur's application of chemical methods. Before his time such observations as had been made upon the organisms of putrefaction and fermentation were almost entirely morphological. The series of experiments which culminated in the preparation of "Pasteur's Fluid," the solution which contained the minimum of materials necessary to the growth of yeast, was practically the beginning of quantitative work upon micro-organisms. Later on, when Pasteur, and with him most other bacteriologists, were engaged in attempts to attenuate virus by cultivation, the chemical side of the matter seemed of less importance. Now that Pasteur's pupils in the Institute, as well as most other bacteriologists, regard toxins and antitoxins as of more importance from the point of view of medicine than the living organisms themselves, it is the chemical side of bacterial life that is coming into prominence again.

Pasteur's School.

Pasteur was one of the great men who not only conducted investigations themselves, but possessed in the highest degree the power of stimulating others to work. In the issue of the Parisian *Figaro* that appeared immediately after the death of Pasteur, Dr. Maurice de Fleury gave a most interesting account of the "Disciples de Pasteur" in the Rue Dutot. "Although Pasteur has gone," he said, "the Institute will remain as active as ever. This is worth saying to-day, while the news of our great loss is spreading over all Europe. The work of the master is so enduring that the death of the great man is really the death of a saint who regains Heaven after having founded an order. For it is really a kind of religious order in this house full of devotees proved and eminent, monks or missionaries who work in the laboratory unceasingly, or carry their good news into the furthest land of plague or cholera.

"They are full of the communal spirit, each caring more for the

glory of the Institute than for their own reputation. They are without jealousies and rivalries. They despise money. M. Duclaux gives a quarter of his salary as sub-director to the young investigators' refectory. Last year M. Roux had a salary of 7,000 francs. Against his will it was raised, and, being unable to refuse it, he put the additional three thousand francs in the common purse." This is that M. Roux whom the emissaries of the anti-vaccination fanatics delight to abuse as a money-seeking charlatan.

London and Chicago: a Contrast.

To those of us who are "aweary, aweary, because a real London University cometh not," Mr. Herricks' account (in *Scribner's Magazine* for October) of the tropical growth of the Chicago University, brings an admiring envy. "Magnificent buildings, an endowment of over six million dollars bestowed in the short period of four years, and a generous annual budget for current expenses may not make a university, but they create the material condition all essential for any ideal enterprise." These generous materials for a university have come from the liberality of Mr. Rockefeller and of the municipality of Chicago itself.

A curious difference between the hard and fast rules of an English University and the flexible ordinances of Chicago is seen in the regulations for attendance. At Chicago each course lasts twelve weeks. A student may reside only one term in the year, and thus spread out the duration of his studies indefinitely. Already, many who are usually deprived of the opportunity for university study by the necessity for continuous residence, have matriculated with the intention of working one term a year, earning their living during the remainder of the year, and spreading out their course over many years. The Scots universities, by limiting their sessions to six winter months, used to attract many students of this kind; and a number of Scotsmen who rose to great distinction were labourers or fishermen for six months, university students for the other six.

An interesting feature of Chicago is the preponderance of post-graduate study. Every possible facility is given for this, and in the present year over three hundred graduates, one-third of the total number of students, were in residence. The attraction to these is the doctor's degree, which, in the fashion of German universities, is to be obtained only after special research work. Thirty thousand dollars a year are offered in fellowships and scholarships to such students: many of the department libraries are reserved for their use, and it seems likely that Chicago is to be the home of a great body of investigators.

It is this last matter that touches the raw of London most surely. The scattered existing institutions provide tolerably for young students and for elementary work; but there is less facility for research in London than in the smallest continental university town. Here and

there, at University College, at South Kensington, at the Zoological Gardens, and at some of the medical school laboratories, a few private investigators are given opportunity by the kindness of those in charge. But there is no place where a graduate may go as a right; there is no convenience of libraries or of laboratories. For this reason alone every scientific man in London, in season and out of season, should press for a central, working university.

Catalogue of Medical Literature.

The sixteenth and last volume of that colossal catalogue, the "Index Catalogue of the Surgeon-General's Office of the United States Army" has just been published. This work, the best of its kind extant, is practically a complete index to medical literature, and contains a great number of works more or less connected with the other natural sciences. The library contains, says *Science*, 116,847 books and 191,598 pamphlets. The present volume deals with 12,759 authors' titles, representing 4,857 works and 11,613 pamphlets. We doubt if so large a collection of medical works exists elsewhere, and it speaks well for the United States Government that a comparatively young library, as compared with the libraries of the Old World, should be in such perfect condition. The library has increased at such a pace that no less than five new volumes are needed to record the accessions since the work began, and these will immediately be prepared. This sixteenth is the last volume that will be issued under the personal supervision of Dr. John S. Billings, and we offer our hearty congratulations to him and to his staff on the completion of so gigantic a monument and so valuable a book.

Bibliography of American Algæ.

The number of papers on marine algæ, especially those dealing with the systematic branch of the subject, increases so rapidly that it is extremely difficult for students to avoid missing some important paper, published, as is so often the case, in some rather inaccessible periodical. This difficulty is, perhaps, especially felt when it is desired to study the algæ of some particular part of the world, and the publication of a complete list of the literature dealing with certain areas is much to be desired.

Such a list of the literature of American Algæ has lately been compiled by Miss Josephine E. Tilden, and published as part xxiii. of the *Minnesota Botanical Studies*. It includes the titles of all papers in any way referring to algæ, marine or fresh-water, which occur in America. The geographical limit is wide, and includes, besides North and South America, the West Indies, Galapagos Islands, and even Tristan d'Acunha and Inaccessible Island. We venture to think that this range is too wide, and that such oceanic islands as the two last-mentioned should not be included in a list of papers supposed to be

American. In point of distance they are nearer to the Cape of Good Hope, the marine flora of which includes nearly all the forms found at these islands. In her selection of papers, Miss Tilden has a hard task, and it is difficult to see on what grounds she inserts or rejects a paper. She apparently wishes to include any publication which makes mention of an alga as occurring in America; but to do this it would be necessary to mention almost every monograph of marine algæ and a large number of papers on their morphology. For instance, if Mr. George Murray's paper on *Halicystis* and *Valonia* in the *Phycological Memoirs*, 1893, is cited, because the specimens examined were collected in Bermuda, why are the papers on *Struvea* (*Annals of Botany*, vol. ii., no. vii., Nov., 1888) and *Avrainvillea* (*Journal of Botany*, March and April, 1889), by the same author, omitted? In both of them American and West Indian species are described. This holds good in several other cases. It would surely have been better to include all papers without exception that refer to algæ as found in America and to omit such publications as 562, 946, 1,250, 1,266, 1,267, etc., which refer solely to the cleaning, mounting, and preserving of Diatoms.

Bibliographical work, to be of value, must be done critically and completely. In this case the errors of inclusion are, perhaps, more formidable than those of omission. Miss Tilden hopes to make additions to her list, and she would do an equally good service by first clearing it of much that is irrelevant to the subject.

Dr. John James Wild.

We regret to find that our "Challenger" number was guilty of homicide, which we hasten to assure our readers and the good man it killed was quite unintentional. Dr. John James Wild, who was a member of the civilian scientific staff in the double capacity of secretary to Sir Wyville Thomson and natural history draughtsman to the Expedition, is, we are glad to learn, still of this world. Not merely Plate xvii., but most of the illustrations in our July number are copies of Dr. Wild's original drawings made on board ship, a circumstance which gives them a far greater value.

For many years Dr. Wild has been living in Melbourne, where he has occupied himself in drawing the plates for Sir Frederick M'Coy's "Prodromus to the Zoology and Palæontology of Victoria." This important publication has been greatly delayed on account of the reduction by the Government of the funds voted for scientific purposes, on the plea of retrenchment. The palæontological plates, including many interesting drawings of fossil fishes, have not yet been published, although printed some time ago. It is to be hoped that circumstances will soon change and permit us to see these beautiful examples of scientific lithography, of which Dr. Wild sends us a few specimens.

Victorian Mines.

From time to time we receive the Government Reports of the Secretaries for Mines of various parts of the Australian continent, but as a rule they have little besides technical details of a nature uninteresting to our readers. The last received is that of Victoria for the year 1894, a folio full of plans of mines and pictures of gear. The bulk of the report is concerned with the output of gold, and in this connection the secretary deplores the loss of the Government Analyst, Mr. J. C. Newberry, whose latest investigations were directed to the saving of slime-gold. The chief feature for congratulation is the expanse of the coal industry—no less than 80,000 tons increase over the 1893 output is recorded. A number of new mines have been opened in the Jumbunna district, and these, it is hoped, will shortly double the supply. Sixty tons of tin were raised in Victoria, and thirty-five tons of antimony during 1894, while of gold the total amount of 673,680 ounces appears in the Registrar's returns for the year.

Crabs as Geologists.

From the same Government we have received "Reports on the Victorian Coalfields (No. 3)," by James Stirling, Assistant-Geological Surveyor. From this we cull a few items of more scientific interest.

A valuable ally of the field-geologist is, it appears, to be found in the land-crab. Some time ago Mr. Stirling suggested that the work performed by this diminutive excavator in bringing up pieces of the rock forming the subsoil might help the miner to find coal-seams in South Gippsland, just as the burrowing wombat had disclosed stanniferous lode-stuff in the Australian Alps. The hint was taken. A young miner detected small pieces of coal around the burrow of a crab, sank a shaft on the spot, and cut the coal-seam four feet below the surface. From similar evidence the officers of the geological survey have traced outcrops in places where the rock was masked by alluvium.

Gippsland Coal.

With regard to the origin of coal, Mr. Stirling makes some interesting observations. He is of opinion that the coal-seams of South Gippsland have, in all probability, been formed by the drifting of vegetable matter from a distance, and not as the result of the growth and decay of plants in the localities now occupied by the carbonaceous strata. The manner and formation of the European coal-seams of Upper Carboniferous age has long been a difficult question, and of late years very strong evidence has been brought forward in support of the formation of coal by the gradual deposition of vegetable *débris* drifted from a longer or shorter distance from the forest-covered areas. It is, therefore, of considerable interest to find that the Gippsland

coal has apparently had a drifted origin. Among other facts in support of this conclusion Mr. Stirling brings forward the following argument: (1) The absence of true seat-stones containing roots; (2) the occurrence of finely water-worn quartz pebbles and of lenticular deposits of shelly matter in the coal-seams; (3) the difference in the physical structure of the coal; and (4) the remarkable variation in the thickness of some of the seams, and the existence of false-bedded strata above and below the coal. He goes on to discuss the flora of the "oolitic beds" of S. Gippsland, but his remarks on this head are not as clear as we could wish.

The Kea of New Zealand.

In the recent number of the *Zoologist* Mr. Taylor White, who has been farming sheep in New Zealand for many years, has some interesting notes upon the Kea parrot, *Nestor notabilis*. Mr. White writes in a somewhat combative spirit, but his report, despite the science correspondent of the *Pall Mall Gazette*, confirms the accepted belief that the Kea has in recent times entirely changed its habits. Mr. Taylor White was in New Zealand before the Kea began to attack sheep. According to him, it did not originally live upon berries and honey, as Mr. Wallace suggested in his volume upon Darwinism. It lived in the mountains above the forest-line, where berries do not grow, and its food was the lichen upon stones. Shepherds began to find that sheep which had missed a shearing and so had long wool, died suddenly, the only sign of death being a small round hole far down the back. The cause of the hole was found to be the Kea, which, according to Mr. Taylor White, was attracted to the sheep by the resemblance of the wool to lichens, and chose the particular spot because it could hold on securely there, in spite of the attempts of the unfortunate animal to dislodge it. According to the same authority, the parrot had no special predilection for the kidney-fat, but simply picked a hole to obtain blood.

Whether Mr. Taylor White be right in supposing the resemblance of long wool to lichens to have been the cause of change, or there be more truth in the earlier suggestions that the Kea learnt the ease of a carnivorous habit from the pickings of slaughterhouses and afterwards went straight to the sheep, is a minor matter which may or may not be settled; but it is interesting to find additional corroboration from one who has seen the change in progress, of a complete change from vegetable to animal food occurring in a short space of years.

Novelties at the Zoo.

Among the novelties recently added to the collection of the Zoological Society is a chimpanzee of greater size, and presumably, therefore, of greater age, than is usual. These animals have to be

captured by killing the mother, which naturally leads to the importation into this country, for purposes of sale, of very young specimens. But the new chimpanzee, which is a male, is distinctly above this average, and has, therefore, one would think, a greater chance of accustoming itself to the apparently rather unfavourable environment of the Marsupial house.

The collection of apes has also been increased by the addition of another specimen of the Celebesian monkey (*Cynopithecus niger*), one of the animals peculiar to Celebes, that anomalous island—"a fragment of Miocene Asia" as it has been called. The Marsupial house, in fact, which is by no means exclusively, or even chiefly, devoted to harbouring marsupials, concentrates within it ssomewhat odoriferous precincts the chief objects of interest in the Zoological Society's gardens at present. The most salient among the rest of these is, perhaps, the three-banded armadillo (*Tolypeutes tricinctus*), which has the power of rolling itself into a ball, the snout and tail being received into appropriate notches, and the ears neatly folding up so as to pack away comfortably. This armadillo walks upon its toes at a rapid rate. The species has not been on view for some time.

The Biography of a Chimpanzee.

We have seen and read an interesting pamphlet, by Mr. Frank Roper, upon the daily life of a captive chimpanzee exhibited at the Belle Vue Zoological Gardens, near Manchester. It is curious that no one who comes much into relations with chimpanzees can refrain from suggesting that the particular individual of his acquaintance is a species distinct from the ordinary *Troglodytes niger*. Mr. Roper is no exception to this generalisation, which is borne out by the comments respecting "Mafuca" at the Dresden Zoological Gardens and the Bam Chimpanzee of Dr. Giglioli. "Consul" appears to us from the photographs, published in illustration by Mr. Roper, to have been a very ordinary animal, bearing no traces of likeness to the illustrious "Sally," late of the Zoo, to which Mr. Roper has the temerity to liken him. The animal, however, was docile, and learnt a number of tricks which certainly "Sally" did not succeed in acquiring; but then we must bear in mind that the subject of Mr. Roper's biography belonged to the opposite sex. To use a knife and fork would seem to be a difficult feat to an ape with a short and feeble thumb; yet we are assured that the creature ate "like a Christian" with the usual polite appliances of the dinner table, including a serviette with which he carefully wiped his hands after food. The difficulty of reading Mr. Roper's booklet is caused by the fact that we can never be sure when he is speaking in English and when in journalese, the latter language being, of course, not distinguished by the accuracy of the former. The chimpanzee had a habit of studying Nicholson's "Zoology." He "turned over the leaves until he came to the drawing of a

monkey, when he immediately jumped on the book and stamped on it, as though he was anxious to stamp the monkey out." But, on the other hand, he looked for a long time, apparently in admiration, at a picture of the Three Graces. Our valued friend "Orpheus at the Zoo" should read what Mr. Roper says about the susceptibility of the animal to music. "Pains were taken," says Mr. Roper, "to ascertain if he took any pleasure in the music of a band," not, we should say, conclusive proof of the absence of a musical taste if he did not. The resources of Belle Vue were taxed to the utmost, with the only result that the ape ran away in disgust. This does not, however, altogether destroy the myth of Orpheus, as Mr. Roper seems to think it does.

The Thumb in Civilisation.

Dr. W. R. Whitehead, of Denver, Col., sends us a reprint from a medical periodical of a paper he wrote entitled, "The Thumb as an Initial Factor in Civilisation." We have considered it attentively, but we have been unable to find in it any new contribution to science. The author describes the peculiarities of the human thumb, especially its possession of a separate flexor muscle, and he attempts to attribute to the human power of opposing the thumb the beginning of all man's civilisation and superiority over the ape. We cannot, however, agree with him in his attempt to make so much of a single peculiarity. "Counting on the fingers with the thumb," he says, "was the initial effort that led to the discovery of the science of the mathematics. Primarily, to draw on the ground with a stick a triangle, to consider its sides and angles, and to discover some of its properties were but additional steps in this direction." One could count on the fingers without an opposable thumb; and an opposable great toe would be as convenient for drawing triangles upon the ground; while, even if the triangles were drawn by it, we do not see how the opposable thumb would lead the ancestral man to consider sides and angles.

But Dr. Whitehead touches a matter of greater interest, and falls into a greater error, when he makes the following statement:—"It appears that the organs of apes which most resemble the same organs of man are not all assembled in any one kind of ape, but seem to be confusedly assigned to very dissimilar apes, and even to half-apes, as if to oppose a barrier to those who shall attempt to trace a too near kinship between these animals and man." It is, as he says, quite true that the bridging brain-convolutions are present in spider-monkeys, and, possibly, in the orang; that lemurs have thumbs more resembling those of man than are to be found in higher apes; that, indeed, analogues to the peculiarities of man are to be found scattered here and there among the primates. But the old idea of arranging modern groups in lineal series has long been abandoned; no comparative anatomist would dream of seeking the ancestors of man

among existing monkeys. The existing primates, including man, have diverged in different directions from common ancestors, and the presence of scattered resemblances among existing forms is precisely what theory demands.

The Alkaline Secretions of Moths.

Recently, Mr. Oswald H. Latter showed that a number of moths assist their emergence from the cocoon by softening its anterior end with a strongly alkaline fluid. In a recent communication to the Entomological Society of London, he described a method by which he was able to collect from the mouths of moths on the point of emerging from the cocoons considerable quantities of the fluid. Analysis showed that it contained 1·4 grammes of potassium hydroxide in every 100 c.c. The fluid is contained (in the case of *Dicranura vinula*) in a diverticulum of the mesenteron, which grows out during pupal life immediately behind the stomodæum. The digestive fluids of the larvæ are strongly alkaline. When the caterpillar becomes a chrysalis, the digestive fluids have no longer any work to do; they are stored up, and perhaps concentrated in the diverticulum, and are thus ready to be discharged when the moth is on the point of emergence.

In the same paper, Mr. Latter mentions his discovery of another interesting structure, which he has not yet been able to investigate in detail. At the time of emergence, a short, wide tube opens into the posterior third of the rectum at one end; at the other it opens into the body-cavity. This tube is full of a reddish fluid which is discharged copiously from the rectum immediately after the emergence of the imago. We trust that Mr. Latter will speedily give us further information as to the origin and fate of this remarkable structure. Any openings into the coelome are of morphological interest.

Veiled Medusæ.

In most of the text-books of zoology, as W. K. Brooks points out in his paper on "The Sensory Clubs or Cordyli of *Laodice*" (*Journal of Morphology*, 1895), it is laid down that there is a fundamental distinction between the sense-organs of the veiled Medusæ that come from hydroid stocks and those of the veiled Medusæ which develop directly from the egg. The Hertwigs first made the distinction, and it was adopted by Hæckel. It was supposed that Medusæ with direct development (Trachymedusæ) had auditory clubs with sense-cells of ectodermal origin, while the concretions within these (otoliths) were endodermal. Veiled Medusæ that develop from hydroids were supposed to have marginal sense-organs composed of vesiculated, concretionary, ectodermal cells and sensory cells with sensory hairs supplied from the lesser nerve-ring.

Mr. Brooks has now shown that in many of the "Leptolinæ," in

Laodice and its allies, true endodermal sense-clubs are present, differing only from those of the Trachylinæ in the absence of concretions.

The Senses of Medusæ.

In the same paper Mr. Brooks discusses the physiological nature of the sense-organs of *Laodice* and other Medusæ. He thinks it probable that the sense-vesicles of Medusæ, Mollusca, Crustacea, Brachiopoda, *Doliolum*, and many other invertebrates, may give sensations of sound, but that it by no means follows that this is their only or primary function. In the case of eyes, he thinks it easy to believe that all incipient stages of evolution have been related to light. Indeed, we know that protoplasm itself responds to light, and the various stages of mechanical combinations of sensitive cells, pigment and transparent cells, and focussing cells, are not difficult to imagine. But hearing is different; and he suggests that change of function has played a part in the evolution of auditory organs, since sound has no direct effect upon protoplasm.

Mr. Brooks suggests that possibly the primitive object of these sense-organs with their concretionary masses was to give a sense of gravity. Medusæ are animals nearly of the same specific gravity as the fluid in which they live. An obvious way in which they could appreciate special relations would be if delicate weights were placed round their margins in close relation to the nerve-ring. The slightest tilting would cause a different impression upon the nerve-ring at the different parts of the circumference, as the mobile organs containing the heavier concretions would press differently upon the circumference. "Among the veiled Medusæ the sense-clubs are found in three different stages of perfection:

"1. In the Thaumantidæ and Cannotidæ they are simple clubs, with an enlarged tip, united by a narrow stalk to a sensory eminence on the nerve-ring.

"2. In the Narcomedusæ and in the Aglauridæ among the Trachymedusæ, the enlarged club-shaped tip of the projecting club is loaded with calcareous concretions.

"3. In most of the Trachynemidæ the sensory eminence is raised up around the club in such a way as to enclose it in a sensory vesicle, which, in the Geryonidæ, is embedded in the gelatine of the bell."

Comparison of the figures given by Mr. Brooks with those which the Hertwigs give (in their memoir of the nervous system and sense-organs of the Medusæ) will show that we here have the same organ in three successive stages of perfection. It is clear that each successive stage is adapted for increasing its efficiency as a weight organ, although it is only in the last and most perfected stage that it affords any basis for the analogy with the "auditory organs" of other animals upon which the Hertwigs base their belief that the sense-clubs are ears.

The Plymouth Laboratory.

From the Report of the Director of the Marine Biological Association at Plymouth, we learn that the new system adopted for supplying the tanks in the laboratory with sea-water has shown itself to be a decided improvement upon that originally used. By the new arrangement the water supplied to the laboratory has not been previously used, while the water in the reservoir and the aquarium is constantly replaced by water from the sea. The improvement thus obtained is shown by the fact that foraminifera have been satisfactorily reared, and colonies of hydroids are now found on the sides of the tanks. Soles have also bred this year, and this is the first record of soles having bred naturally in confinement. Shallow tanks have been placed immediately under the windows on the south side, and the direct action of sunlight has kept the water in good condition for the support of delicate forms of animal and vegetable life. The Government grant from the Royal Society will be used towards the expenses of boat hire in connection with an attempt to extend the dredging and trawling work to deeper water between Start Point and the Eddystone. A novel feature in the year's work is the record of a visit made by five University students under Mr. Garstang, to make a general study of living marine animals. When the tables are not all in occupation by naturalists, and so long as it does not interfere with the proper work of the institution, this seems a useful innovation. Professor Weldon's researches on the abnormality of crabs necessitated the fitting up of 500 separate bottles, allowing for a current of sea-water through each bottle; each crab had to be fed daily, and Professor Weldon's results were only arrived at after a maximum of care and labour. The arrangement of the typical specimens in the Museum is making satisfactory progress under Messrs. Garstang, Taylor, and Hodgson. Mr. J. P. Thomasson has renewed his donation of £250 for fishery investigation in the North Sea.

Mr. G. W. Butler reports on the spawning of the common sole; Mr. Cunningham continues his North Sea investigations, and has further evidence on the influence of light on pigments; while Mr. Allen writes some faunistic notes, and on the reproduction of the lobster.

Fresh Herrings.

"The voyage was not considered successful, and the catchers seem less inclined every year to risk life and capital in this enterprise." So says Mr. C. Stacey-Watson, in the *Transactions* of the Norfolk Naturalists' Society, regarding the spring fishery of the Yarmouth and Lowestoft boats; and this seems to be due to the large importations of Scandinavian-caught fish, and to the fact that fishing in the Moray Firth begins earlier than formerly. However this may be, the two sets of fishermen secured no less than 24,441 lasts

6 thousands in the four fishings of Spring, Midsummer, North Sea, and Home. The fishermen seem rather to prefer to fit out their boats and send them to the West of England to the great mackerel fishing. A total of 464 boats were engaged during 1894 in the Herring fishery, with a complement of 2,974 men and boys. This includes the boats from Scotland. The highest catch for the year amounted to 23 lasts 8 thousands, and the biggest delivery in one day was made on October 30, when 132 boats landed at Yarmouth no less than 541 lasts of fish. The average return of the Yarmouth boats was about £750, that of the Scotch £300 to less than £100. This falling off in Scotch hauls is due to the fact that they had the misfortune to fall in with a large school, which, in many cases, struck their nets and filled them so heavily that they carried them to the bottom, twisting and entangling them to such an extent that many of them were so injured as to be of no further use.

A New Case of Symbiosis.

In the most recent issue of *Le Botaniste* (série 4, fasc. 4, 5), Mr. P. A. Dangeard describes a new and remarkable case of symbiosis. Unlike the lichen, where an alga and fungus club together for mutual benefit, we find here an intimate association of two basidiomycetous fungi, *Dacryomyces deliquescens*, and one of the Tremellineæ. The former plays the principal part, entering most largely into the constitution of the thallus. The different shape of the basidia enables us to distinguish the two species, the hymeneal layer containing a mixed assemblage of the ovoid basidia of *Dacryomyces* and the larger cylindrical ones of its associate. Mr. Dangeard found them in September of last year growing on dead wood, but it was only after a detailed study of the specimens that he realised the presence of something other than a normal *Dacryomyces*. As the discoverer observes, it is difficult to imagine what mutual or selfish advantage can ensue from this association of two parasitic fungi.

The Ascent of Water in Plants.

We referred in our last number to some recent work by Messrs. Dixon and Joly on the vexed question of the manner of ascent of the water in the stems of plants. In the latest issue of the *Annals of Botany* (vol. ix., p. 403) the same authors recount some experiments on the subject, in connection with the behaviour of the leaves on a shoot or branch when the lumina of the vessels are choked with foreign substances. Cocoa-butter had already been used by Elfving and gelatine by Errara and Strasburger; besides repeating the older experiments, paraffin wax of low melting-point was also employed, and in another set carbonic acid gas was liberated in the vascular tissue by the reaction of sodium bicarbonate and tartaric acid. All these experiments tend to show that, while the freedom of the lumina is necessary for a rapid and at all adequate transmission of water, yet

a slow current may pass through the wood even when the cavities are completely blocked.

In their work with paraffin, interesting casts of the interior of the conducting tissue were obtained by steeping the wood of injected branches in sulphuric acid. "A single night suffices in many cases to remove the wood and leave the paraffin casts of the vessels streaming upwards from below like a sheaf of fine white threads." It was easy to demonstrate in this way the continuity of the elements forming the vessels in the lime, sycamore, and elm.

Postage of Natural History Specimens.

At the close of his article on the International Zoological Congress, Professor Hickson alludes to the resolution that was unanimously adopted concerning the transmission of natural history specimens from one country to another through the post. We have not been behind our scientific contemporaries in occasionally drawing attention to the anomalies and inconveniences of the present restrictions; notwithstanding which we often receive letters asking us to ventilate the matter still further. The question, however, being an international one, it has not seemed to us that isolated and ill-timed action would be of much avail. But the time is now ripe for concerted agitation to begin.

The present facts are these. The Universal Postal Convention has forbidden absolutely the sending through the mails of "animals and insects, living or dead," with the sole exception of live bees. Other natural history specimens, such as fossils and minerals, must be sent by the ordinary letter-post, at the usual rate of 2½d. per half-ounce, a charge which is almost prohibitive in many cases. At the last meeting of the Postal Union it was proposed by the Post Office of the United States that natural history specimens should be sent under the same conditions and at the same rate as samples of merchandise, that rate being the same as for book-post, except that the minimum charge is 1d. In favour of this proposal there were seventeen votes, and against it there were seventeen, but, since a vote of two-thirds was required to carry it, the proposal was defeated. The administrations voting against the amendment were those of Germany, Austria, Hungary, Bolivia, Canada, Spain, Great Britain, Guatemala, British India, Japan, Norway, Portugal, Russia, Sweden, Tunis, Uruguay, and Venezuela.

The next meeting of the Postal Union will be at Washington in 1897, and the Zoological Congress has respectfully requested the Federal Government of Switzerland, which country is now the seat of the bureau of the Union, again to bring forward the above proposal at the forthcoming meeting. It therefore becomes the duty of zoologists and men of science generally, in all countries, to urge the claims of this proposal upon their respective Governments, so that they may instruct their delegates to support it.

Adders Again.

We would direct the attention of those who continue to contribute to the *Field* their experiences of adders swallowing their young to the following paragraph which we cull from a recent publication :—

"It is painful to witness the agony of a mother snake sometimes when, in the flurry and excitement following the appearance of a man amongst the group of reptiles, the offspring of some other snake accidentally take refuge down her throat. She has not the capacity to hold her neighbour's young and her own, of course, and when she has been filled up with strangers and a couple of stray ones of her own appear upon the scene and clamour for admission, her position indeed becomes a trying one. The enemy is at hand, there is no time to disgorge and re-assort the cargo, and the poor old snake is compelled to wriggle away as fast as she is able, leaving her own offspring to perish while she reluctantly saves the lives of others which do not belong to her."

Chinook.

The Smithsonian Institution (Bureau of Ethnology) is doing all in its power to collect and preserve the Indian dialects, now so rapidly passing beyond recovery. The latest publications are "Chinook Texts" (1894), in which various myths of the Clatsop and Chinook tribes are set down with a readable English translation. The collection of this dialect was made in the very nick of time, for Dr. Franz Boas found only two individuals who could speak the dialect. One of these, named Charles Cultee (or more properly Qjeltē') proved a veritable storehouse of information, and so grasped Dr. Boas's wishes that he even explained the grammatical construction of the sentences and elucidated the sense of different periods. In the other volume, "The Siouan Tribes of the East" (1894) Mr. James Mooney has given the synonymy of the different tribes dealt with and an historical sketch from the earliest times to the present.

In the Twelfth Report of the Committee on the Fossil Phyllopoda of the Palæozoic Rocks, handed in to the British Association at Ipswich by Professor Rupert Jones, a list has been drawn up of all species referred to in the Reports between 1883–1894. The Report is also interesting from the fact that Professor Lapworth has drawn up a table of the comparative nomenclature of the Lower Palæozoic Rocks from the *Olenellus* zone to the Ludlow series, which will be useful to others than the student of phyllopods, and a table of the geological range of genera and species. Professor Jones gives a fourth table showing the geological order of species.

I.

Louis Pasteur.

BORN AT DÔLE, IN THE JURA, DECEMBER 27, 1822.

DIED AT VILLNEUVE-L'ÉTANG, NEAR ST. CLOUD, SEPTEMBER 28, 1895.

THE facts of Pasteur's life have been so fully detailed in the newspapers that we do not propose to recapitulate them. Those who desire such information may be referred to "Louis Pasteur: His Life and Labours, by his Son-in-law"; translated by Lady Claud Hamilton; New York, 1885; and to an article by Sir James Paget in *Nature*, vol. xliii., pp. 481-485, March 26, 1891. A complete list of Pasteur's writings is given in the *Revue Scientifique*, 4 ser., vol. iv., pp. 427-431, October 5, 1895, which may be purchased for sixpence of Mr. T. Fisher Unwin.

I.—PASTEUR AND THE RUMFORD MEDAL.

IN the year 1856 the Rumford Medal of the Royal Society was awarded to Louis Pasteur. It has often been stated, and is usually repeated in accounts of his life, that the medal was given in recognition of his researches on the polarisation of light; from which it might be supposed that his early studies were in purely physical science, and that he had suddenly and capriciously abandoned that subject for biological investigation. But this would be an entirely erroneous impression. The research contemplated in the award was one which contributed nothing new to the knowledge of polarised light; the medal was awarded to Pasteur, in the words of the President, "for his discovery of the nature of racemic acid and its relation to polarised light."

Another fact commonly overlooked in the popular appreciations of Pasteur's work is that this discovery was intimately related to his subsequent researches, and possessed for him an immense biological interest. During the years 1848 to 1857 he published no less than sixteen papers on this and kindred subjects, and it is interesting to trace in these the dominating idea which led him to the study of ferments and thence to the classic discoveries which have made his name so famous, that in the world at large his earlier labours are almost forgotten.

It is not too much to claim for the discovery relating to racemic acid that, in the domain of crystallography, it was the most important of the present century; while in chemistry it laid the foundation of an entirely new branch of science, now known as stereo-chemistry; one which has been more stimulating to research and more fruitful in result than perhaps any other of modern date.

Those who had the pleasure of hearing Professor Percy Frankland's evening lecture at the British Association meeting at Ipswich will recollect as one of the most vivid reminiscences of the great chemist's life how, when engaged upon his earliest important research, he rushed from his laboratory, and, falling into the arms of a friend, exclaimed enthusiastically, "Je viens de faire une grande découverte!"

The discovery was this. Both tartaric and racemic acids were known to chemists; so far as could be seen they were absolutely identical in all their chemical and physical characters, with one exception; further, from them could be derived a series of tartrates and racemates respectively which appeared to be also identical, with the same exception. The difference lay herein, that while solutions of racemic acid and the racemates were without action on polarised light, solutions of tartaric acid and the tartrates rotated a transmitted beam of plane polarised light to the right. Now Pasteur observed that the crystals of the latter substances (if account be taken of certain minute facets which they present) are dissymmetric; that is to say, any one of these crystals, when held before a mirror, has a shape different from that of its image. It is precisely analogous to the case of a right hand which, when viewed in a mirror, becomes a left hand. Now if there be a relation between the form of the crystal and the properties of the solution, it might be expected that a solution which turned plane polarised light to the left would furnish crystals having the form of the mirrored image. On examining the crystals obtained from the inactive solution of racemic acid, Pasteur found that they consisted of equal quantities of two distinct sorts of crystals bearing precisely this relation to each other: a solution of the one was dextro-rotatory, and the solution of the other was lævo-rotatory. In the solution of racemic acid, which contains equal quantities of both, they neutralise each other's effects, and the solution is without action on polarised light. The two sorts of crystals resemble two similar spiral staircases, one of which twists to the right and the other to the left. Even if they be broken up we can take any one step and say from its shape whether it belongs to the right- or to the left-handed staircase; and in the same way when the crystals are broken up and dissolved, it is possible, from the optical action of the molecules in the solution, to predict the sort of crystal which they will construct.

Biot, hearing of this striking discovery, sent the young chemist some crystals of racemate of sodium and ammonium and begged him to separate them by their forms, in order to ascertain whether their

solutions were also optically active. The result may be told in Pasteur's own words: "M. Biot prépara les solutions en proportions bien dosées et au moment de les observer dans l'appareil de polarisation il m'invita de nouveau à me rendre dans son cabinet. Il plaça d'abord dans l'appareil la solution la plus interessante, celle qui devait dévier à gauche. Sans même prendre de mesure, par l'aspect seul des teintes des deux images ordinaire et extraordinaire de l'analyseur, il vit qu'il y avait une forte déviation à gauche. Alors très visiblement ému l'illustre vieillard me prit la main et me dit 'Mon cher enfant, j'ai tant aimé les sciences dans ma vie que cela me fait battre le cœur!'"

Subsequent researches in the hands of Van t'Hoff and others have led to the further discovery that the dissymmetry of the crystal corresponds to a dissymmetry in the chemical structure of the substance, and this has resulted in a vast amount of observation, experiment, and speculation upon the structure of chemical compounds and the possible arrangement of the atoms within the molecule.

But to Pasteur himself the interest of the matter was not mainly chemical or physical. Nothing could better illustrate how a brilliant intellect can achieve splendid results by the deductive method so congenial to the French scientific school. In Pasteur's eyes this dissymmetry was nothing less than a great characteristic feature which distinguishes living from non-living matter; the quality of dissymmetry he believed to be peculiar to substances, such as sugar and albumen, which are formed by the action of life. "L'univers," he said, "est un ensemble dissymétrique. Je suis porté à croire que la vie, telle qu'elle se manifeste à nous, doit être fonction de la dissymétrie de l'univers ou des conséquences qu'elle entraine."

It is easy to understand how this opinion was confirmed by his next discovery, that a living organism (*Penicillium glaucum*) is capable of acting upon a solution of a racemate so as to separate the right-handed from the left-handed tartrate; and this discovery was a step which led him on to the study of ferments and further from the study of crystals.

The view that dissymmetry is peculiar to the products of life is now abandoned, but was held by Pasteur himself, at any rate until a recent date. There can be little doubt that it was the desire to study the nature of life which inspired him in his early researches on dissymmetry in crystalline compounds, and led him to make these brilliant discoveries in crystallography and chemistry which now appear so widely separated from biological science.

H. A. Miers.

II.—The Clinical Results of Pasteur's Work.

IN attempting to estimate the benefits conferred upon medicine, surgery, and the allied sciences by the direct and indirect results of Pasteur's work, the first impression is one of surprise that so much

should have arisen from the labours of a man who was himself no physician or surgeon, who laid no claim to any clinical knowledge or experience, and was practically a pure scientist. It has been the fashion among some, even in the medical profession, to decry pure science in medicine, and to maintain that empiricism has always proved the surest basis for medical and surgical practice. No more unanswerable argument can be adduced against such than the results of Pasteur's work—which have, partly in his own hands, but much more largely in the hands of those who have followed him and practically applied and developed the principles which he laid down, gone far to revolutionise surgery and obstetrics, to afford a sure and definite basis for preventive medicine, and to point out new lines of treatment which have already done much to reduce the mortality from certain infective diseases and will probably be still further extended in the future. It is the fashion, again, among those who profess an abhorrence of experiment upon living animals, to cry out at the absence of practical result from such proceedings. No more beneficent and far-reaching practical results can be conceived than those which have flowed from Pasteur's researches; and they are due to the application of a rigid experimental method upon living animals.

A distinction must be drawn between the clinical results achieved by Pasteur himself and those which, in the hands of others, have resulted from the application of his discoveries. The latter far outweigh the former, and this is not to be wondered at. Pasteur was primarily a chemist and physicist, and ultimately a biologist, and he was compelled to leave for the most part to others the clinical application of the facts and principles which he had himself established. Nevertheless, he was impelled in some cases to undertake this clinical application with his own hands,—notably in the case of protective inoculations against anthrax and rabies: it is indeed with the extension of the latter mode of treatment to man that his name is most widely known to the public.

It has been claimed for Pasteur that he was the founder of bacteriology. In a sense this may be true, but it is in a general sense only. His discoveries on the subject of fermentation and, above all, the brilliant experiments by which he settled the question of spontaneous generation, first rendered possible the accurate study of micro-organisms. The methods of sterilising cultural media by heat, perfected by Pasteur and Koch, constituted a very great advance in this study. These were matters which Pasteur's training as a chemist and physicist, and his marvellous faculty for original experiment, rendered him particularly fit to investigate. It is not too much to say that the laying of the foundations upon which the superstructure of modern bacteriology has been raised was in a very great measure Pasteur's work. But to the superstructure itself he added little. No unprejudiced mind comparing Pasteur and Koch—as bacteriologists

—can doubt that the development of modern bacteriology is owing in far larger share to the labours of the German scientist.

There is, however, one great branch of bacteriological study with which Pasteur's name will be for ever associated. He, first of all men, conceived and carried out the attenuation of the living virus of a disease and practically applied it for the purpose of protective inoculation. The methods which he employed are a matter of history: they may be superseded by better methods, but nothing can detract from this crowning service of Pasteur to medicine. His earlier efforts in this direction were naturally made upon animals, since in them only could rigid experimentation confirm the truth of his views. The results, in the cases of anthrax, fowl-cholera and swine-erysipelas, were successful: it was found possible by inoculation with a culture of mitigated virulence to produce a mild and non-fatal attack of the disease, which nevertheless protected against the effects of cultures of high virulence. The advantages thus offered to farmers and breeders of animals have been largely made use of in infected districts, but it must be confessed that the expectations which were at first raised have not been completely fulfilled. In the case of anthrax, for instance, it has been found so difficult to produce a "vaccine" of uniform strength that a certain proportion of the inoculated animals die, while others are found insufficiently protected. In spite of this, the method is still employed, especially in infected districts, and with good result. The extension of this method to the treatment of hydrophobia in man was Pasteur's next step, and certainly constitutes the most striking direct clinical application of his discoveries. The absence of any demonstrable microbe in rabies and the impossibility of cultivating the virus outside the animal body were grave difficulties in his way, but these were overcome. Until Pasteur took up the subject, there was no sure pathological or clinical criterion of what was, or was not, rabies. He showed that by inoculation of portions of the spinal cord of an affected animal into the central nervous system in rabbits the disease could be surely reproduced, thus affording a decisive test as to the nature of any given case. This, from every point of view, was a discovery of the highest moment, and it was followed by the further discovery that the spinal cords of affected animals gradually lost their virulence on drying. The application of the principle of protective inoculation was then easy, but became at once of greatly increased value when it was found that protection was afforded by inoculation of the mitigated virus, even after infection from a rabid animal. From these observations has arisen the system of anti-rabic inoculation now practised at the Institut Pasteur and similar institutions elsewhere. Much vilification has been heaped on its author's head by his opponents, and it must be admitted that the system is still on its trial. In attempting to criticise its results the primary difficulty encountered is that we have no accurate statistics of rabies mortality from which we can start. The mortality among

persons bitten by rabid animals has been variously estimated at from 5 to 50 per cent.: Horsley's estimate of 15 per cent. for those bitten by rabid dogs is one which is generally accepted, but we have no evidence as to the mortality among those bitten by animals proved to be rabid by exact pathological test. In the statistics furnished by the Institut Pasteur the cases are grouped according as the animal inflicting the bite was proved to be rabid, merely certified as such, or only suspected. An unbiassed survey of the results of the Pasteur treatment shows a very marked decrease in the mortality—viz., to something like 1 per cent. This is an enormous advance on any other method of treatment, but it is in harmony with the experimental evidence on dogs, and there appears no reason to doubt the substantial accuracy of the figures. It is probable enough that further advances will be made, and it may be that this method will be replaced by others: indeed, attempts are already on foot to apply the system of serum therapeutics to rabies. Meanwhile, there can be little doubt that Pasteur's method has been the means of saving many lives from a particularly painful and horrible death.

Such are the direct clinical results of Pasteur's work: into all the indirect results it is not possible to enter here. As we have already said, he laid the foundations on which modern bacteriology has been built up, and it follows that, although the building has been done mainly by others, some share in the credit for the revolution which bacteriology is effecting in every department of medicine and surgery should be assigned to him. The system of antiseptic surgery in particular may be instanced as originating, in the hands of Lister and others, as a fairly direct outcome of his teachings. The results of this system, now almost universally adopted, have been enormously to diminish surgical mortality, and to render safe and possible operations which were previously beyond the dreams of the surgeon. Midwifery, too, has felt Pasteur's influence, in the largely decreased mortality which has followed the introduction of a strictly antiseptic line of treatment. Preventive medicine has gained a sanction which it never had before, and which has placed it on a firmer and surer basis. And all this has been the outcome of the broad and brilliant generalisations which Pasteur laid down, as the result of minute and patient experiment in pure science.

F. W. Andrewes.

II.

Some Casual Thoughts on Museums.

Part II.

Geological Museums.

IN a previous paper (Natural Science, vol. vii., p. 97) I ventured to make some dislocated remarks on museums, especially on local museums, and on that department of the great national museum which answers to local museums elsewhere. I have been asked to devote a little space to geological museums and their arrangement. Here again the concrete seems to me more useful than the abstract, and we have in London a notable instance of how very unmethodical great teaching institutions may become if they grow up by mere hazard. There is in Jermyn Street a first-rate geological museum, the only one in this country. It is essentially a geological collection arranged stratigraphically, and is in many respects a model of what such an institution ought to be; but in others it fails very materially. Its situation is one of the worst in England, for it occupies a site so valuable that there is no proper means of housing its staff, or of enlarging the collection itself, and its very existence is hardly known to nine-tenths of the scientific world. It is the special child, first, of the old School of Mines, and, secondly, of the Geological Survey, and has naturally grown up on the spot occupied formerly by the great teaching centre of geological science. So long as that remained there, many reasons existed for retaining the museum in the same position, but now that the great central Government school for teaching geology has moved elsewhere, there is no longer the same excuse for keeping the museum where it is. Few people know of its existence, and it is really a very considerable light hidden under a very notable bushel. The situation, too, is one where dirt and dust, the great enemies of all collections, accumulate. The building is, in fact, the home of one heroic story: was it not in one of its rooms that a student of geology, being asked to distinguish between *transparent*, *translucent*, and *opaque*, wrote down that he always preferred to define by illustration? "Thus," said he, "the window above me was once transparent, it is now translucent, and it will speedily become opaque." The rooms in which the staff of the museum and of the Geological Survey are housed are a disgrace to a country like ours, and perhaps

account for the unhappy and dejected look of so many geological surveyors when not engaged in field-work.

There is literally no reason except a sentimental one why the museum in Jermyn Street should continue to exist where it is. The site, being valuable, would, if sold, easily realise enough to build another wing to the great Museum of Natural History at South Kensington, where the collections could be suitably housed and accommodated, and I know some men, wiser than myself and quite as disinterested, who think with me. The removal of the collections is, however, not all that is required. The museum itself ought to be entirely revolutionised. It contains very heterogeneous and discordant collections. The practical science of mining, which is largely an *art*, together with the various arts supposed to be connected with the mineral products of the earth, are all illustrated in a most confusing way. Because a potter needs clay to model his pots with, we have in the museum, not only different kinds of clay, but illustrations of the various processes of the potter's art, with special and valuable collections of different kinds of pottery, *e.g.*, a small but fine collection of Majolica, a very fine one of Roman pottery from Colchester, the finest collection of Staffordshire ware in the country, and a very large collection of English porcelain. What has all this to do with geology? In the same way, but not to the same extent, the art of the metallurgist, of the polisher and engraver of precious stones, and every conceivable art dealing with things earthy and stony are here illustrated. Why, then, should not all the arts under heaven be taught in this museum, including that of the chiropodist, for are not corns and bunions the remote results of walking in fashionable boots on *stones*? The incongruous exhibits have no doubt come there, some by accident and some by design, but they ought not to remain any longer. There was a time not long ago when in no museum in England was the art of the potter illustrated at all. Hence it was useful to have some bourne where such collections might eventually rest in peace, dust, and neglect, until better times should come. Now, things are very different. Such collections exist, well exhibited and arranged, at the British Museum and at the South Kensington Museum; thither things of the same kind, now buried and lost in Jermyn Street, where they are quite out of place, should be transferred, and with them should go to the scientific department of the latter museum all the specimens exhibiting, not the science of geology, but the applied arts ultimately dependent on the miner, the metal-worker, and others. Let us have these arts adequately illustrated, by all means, but let them be taught in their proper place in the museum of applied science, and not in that where the evolution and history of the earth are illustrated. The works of man and the works of nature belong to different spheres of human study, and it must be equally confusing to the student and to the pleasure-seeker to mix them up and to bring into unfair com-

parison the fantastic experiments of Thomas Toft and the finished handiwork of the Almighty.

Having got rid of human art and limited ourselves to the true sphere of geological science, we should still need, in a rehabilitated and reconstructed geological museum which is to approach the ideal, another very important change. The museum in Jermyn Street is, confessedly, only a museum of English geology. Its collections are the results of the zeal of the geological surveyors, and it is the rich and manifold harvest they have gathered which is there housed. I am never tired of preaching (and heretic though I be, I shall continue my homily as long as I have breath) that the great bane of English geology, as now learned and taught, is its parochial, and consequently utterly misleading, character.

There was once a parson who had two small livings in the north of England at different periods of his life, and he persuaded himself, and wrote several books to prove, that almost every important event in English history, including the landing of Julius Cæsar and the Battle of Hastings, had taken place in his parishes in Yorkshire. This is precisely the attitude of the men who are responsible for some of the most elaborate and astounding memoirs on geology which have appeared in recent years under high patronage, and deal with some of the most intricate problems of physical science. These authors have never studied physics or mathematics at all, or only in the most perfunctory fashion. They know next to nothing of the mechanical properties of matter, and they have a contempt for the postulates of the more exact sciences. But this is not all. They know hardly anything, either at first- or second-hand, of the foreign representatives of the English beds. Some of them think that all the secrets of the universe are concealed in half-a-dozen chalk-pits in East Anglia, and that it only needs a few weeks' sojourn in these holes to find Aladdin's lamp. Others, who have never seen a glacier and have never tried an experiment on ice, write great volumes, and get them published at the expense of the taxpayer, upon some of the most crooked issues of physics, which can no more be solved by internal cogitation than the famous camel could be produced by the German metaphysician in the same way. This is the actual basis upon which a good deal of recent English geology has been built, and is it wonderful that the teaching is reflected in our museums as well as in our text-books?

The burden of this oft-repeated diatribe is that, if we are to know the history of our great mother, Gaea, which we profess to narrate under the term geology, we must go further afield than surveying half a dozen parishes or half an English county with no better tools and preparation than a land-surveyor's pencil and levelling dial, and no wider experience than can be got out of a single mountain valley or two. We must also know how our explanations will meet the case of similar phenomena elsewhere; we must know what others better trained than ourselves have written on these problems abroad; we

must restore geological teaching to the lines, and adopt the training, which great men like Hopkins and Sedgwick and Lyell thought it necessary to have when they discussed, not merely a slice of Old England, but the whole realm of Jupiter, Pluto, and Neptune combined. If this be so, we must, in our museum which is to illustrate geology, have a stratigraphical collection commensurate with, and illustrative of, not merely English strata, but the strata of the whole world. Let us in this way try to dispel the rubbish which has been so persistently taught about homotaxial relations between the strata of areas as far removed from each other as China and Peru, Australia and Britain. Let us in this way also get rid of a nomenclature and arrangement of the beds which were perfectly sound and justified so long as they were limited to English geology, but which are absurd and childish when applied to entirely different stories. The history of Europe and the history of China, treated as human communities, differ *toto cælo* at every point, and must be illustrated by collections kept entirely distinct and apart. It seems to me that Chinghiz Khan has as many homotaxial relations with Frederick Barbarossa as the Tertiary beds of the Sivaliks have with those of Europe, with which they are so often confused under a common nomenclature. This end can only be secured by having a stratigraphical collection which shall illustrate the stratigraphy of every separate and distinct geological area as a separate and distinct field altogether.

Thirdly—and here I am afraid my heresies will be less tolerated—I hold it to be a mistake to deal with mineralogy and palæontology as if they were subsections of geology. Collecting fossils, as we all know, is what a schoolboy means by geologising; but some older people believe that geology (meaning the history of the various revolutions which the world has seen) is a different thing to collecting fossils and discriminating the various species of minerals. It is true that, in collating the disordered leaves into which Nature's book has been confused, we find that we can distinguish the various pages in a very satisfactory way by their being ear-marked by the presence of certain fossil forms; and these indices of geological horizons we must have in any stratigraphical collection. But for this purpose it is the reverse of useful to have every fossil occurring at every level exhibited: we want the typical forms alone which specially mark the various horizons. It is they that give us the real pagination, and it is merely confusing the student to exhibit everything contained in a bed as its special ear-mark. The great bulk of palæontological remains do not appertain to geology at all, but to the special provinces of zoology and botany. They illustrate the continuity, or the reverse, of *life*, and not the history of the revolutions of the earth's crust, and should be remorselessly removed from the geological collection to the general biological one. In this way an adequate geological museum illustrating the general geology of the earth becomes a much more manageable affair than many suppose.

In the same way we must, no doubt, in order to understand the sequence and history of many rocks (notably the crystalline and metamorphic rocks), know something of mineralogy and of chemistry; but this does not mean that in our geological museum we are to confuse the natural history of specific minerals with the history of successive strata. Petrology is, of course, very much more germane to geology than is mineralogy—a truth which has only recently begun to be realised in our collections, and it seems to me to be as real a mistake to pile up a large series of mineralogical specimens in a purely geological museum as it is to do the same with palæontological specimens. The mineralogical specimens should be kept apart altogether. Having discarded what seem to myself to be discordant elements from a geological museum as now understood, we should then have left a geological museum devoted essentially to illustrating the problems of true geology. It should contain plenty of models or specimens on a large scale, showing joints, faults, flexures, synclinal and anticlinal curves; the junction of different rocks, illustrating conformity and nonconformity, continuous sections from different areas, either built up of the rocks themselves or with the cores of borings, with good and well-named typical fossils from each horizon in adjoining *table-cases*, and there should, where possible, be actual specimens and not drawings or plans. We should, in addition, have abundant models showing the actual work of living glaciers as distinguished from the nightmares which in recent years have pursued so many romantic writers, who despise experiment and an appeal to facts, as every poet should. There should also be models and examples from the laboratory of the actual results of melting rocks under various pressures and conditions, of the effects of shearing, of dynamical and chemical metamorphosis, of the cavities and cracks caused by earthquakes, of the various mechanical processes of Nature such as we actually find her employing, and in addition different series to illustrate the stratification of different parts of the world, arranged in narrow parallel galleries on similar lines to the admirable gallery arranged in the museum in Cromwell Road by Mr. Etheridge, *only that the stratigraphy of each should be kept distinctly separate*, and there should be no attempts made to fill up gaps in one area by inserting evidence from another. Museums should illustrate facts as much as possible and hypotheses as little as may be. We do not want hypothetical sections and wonderful examples of the ingenuity of cloud-building professors as to the origin of certain phenomena. Let these be remitted to the professors' books, the best of which are necessarily ephemeral publications—alas, that it should be so with so much amusing literature! What we want in museums is not poetry, but prose; we want the actual facts of nature represented, and not the workings of some geological dramatist trying his hand at remaking the universe. Those hideous diagrams of *supposed* internal arrangements of volcanoes, of *supposed* denudations on a wide scale, of the

supposed action of impossible rivers, of glacial nightmares, etc.—let all these be excluded from museums and consigned to geological romances. Let us also exclude those extraordinary diagrams showing the ideally continuous distribution of rocks in which gaps here and gaps there are filled in from other areas. We want the facts, and the facts only, so that the heretic and the orthodox should be on the same level, and so that our museum should not make the architect of the universe responsible for the handiwork of either the most lucid and picturesque of directors of the Geological Survey or the most beaming and popular of heads of Departments of the British Museum for the time being. We want the professor and the museum-keeper to have their little jokes, and we will all laugh at them; but let it be in their own books and not in our common property, the museums.

If we turn from the great National Museum of Geology as it ought to be to local geological museums as they might be, a few words may also be said. I, of course, exclude museums of the size and importance of the Liverpool Museum, or those at Oxford, Cambridge, or Manchester. A local museum, from the exigencies of opportunity, space, and income, cannot possibly illustrate universal geology, and it is a mistake to welcome into its cabinets all the chips of famous mountains, from Teneriffe to Mount Carmel, which enthusiastic travellers stuff into their pockets, and the dislocated bits of spar, rock-salt, and limestone which have come from sporadic visits to stalactitic caverns, to salt-mines, or to the lovely mountains of Styria where I am writing these lines. All this kind of relic is mere rubbish. It is also a mistake to attempt in a local museum more than a small index collection of English strata illustrated by a map and a few sections. The collection ought really to be limited to illuminating the geology of that particular district, and to be illustrated by careful drawings, not necessarily coloured with the geological tints, which one can learn from any small manual, but with the natural colours of the strata, and showing every important section in the neighbourhood where some geological lesson is illustrated—no imaginative pictures, but actual copies of facts as presented by the rocks. Every fault and dislocation should be carefully modelled and coloured and traced. Specimens of the various rocks—not mere chips, but substantial specimens—should be arranged as much as possible in sequence. Above all, when drift deposits occur, the boulders should be collected carefully and labelled, and, whenever ascertained, a specimen of the mother-rock be put near them, and the lines of migration of the travelled stones be marked on a map. It is a disgrace that, so far as I know, there is no adequate and complete collection of boulders in any museum within our four seas illustrating the geology of the drift, not even in the big museums. No wonder we have fantastic postulates introduced into what should be a sober science, and that gigantic ice-sheets filling up great oceans are invented to explain a few boulders occurring near the sea, which have come from the ballast of some

over-weighted or wrecked foreign ship. There ought also to be carefully drawn sections of the curved lines which the laminæ of sand take in the sand-beds of the drift, so that country yokels should have some antidote to the nonsense they may find in geological manuals, where long, continuous, swirling curves, very often reversed, are frequently attributed to the pounding of icebergs or to the internal economy of that mysterious absurdity, a ground moraine. Every well, every mine, and every quarry should, when possible, have the facts it discloses shown graphically either by a model or drawing, preferably a model. In table-cases the typical fossils should be placed with specimens of recent forms, showing what the broken and distorted fossils really mean and what they once were. Some drawings of the animals should also be given, for we have to deal with people who know nothing, or next to nothing; and when a specimen or a series of specimens in a museum ceases to teach something, its further use is not very obvious.

These are only dislocated sentiments, but they condense a theory of geological museums which is not generally adopted, and may suggest a few thoughts to others. I am told that an interesting paper on geological museums was read at the recent meeting of the Museums' Association. This I have not had the advantage of seeing, for I am far away from England; but it is clear that others besides myself look forward to better things in such institutions, and the critic sometimes must precede the reformer. I have more to say, but it will keep for another paper.

HENRY H. HOWORTH.

III.

On the Darwinian Hypothesis of Sexual Selection.

IT seems as if this much-vexed question were as far as ever from being settled. The following pages contain, briefly stated, various facts and considerations that have induced me, in addition to arguments already published, to discard a former belief in "female preferences" as a factor in the evolution of races. I will enumerate, first of all, some miscellaneous objections, passing on later to review the case of one particular species in order to see how far its habits and bodily characters could bear out this hypothesis.

I.—Some General Considerations.

It is difficult, at the outset, to obtain a comprehension of the scope of Sexual, in contradistinction to Natural, selection. To which of the two must we attribute the origin of structures, useful both for combative and life-preserving purposes, or that of many colours artistically beautiful and, at the same time, adaptive? The practical results of both processes seem often to coincide.

Indeed, whether we should appeal to natural or to sexual selection frequently depends on whether a species can be credited with the conscious appreciation of beauty that entitles it to rank among the "higher animals." Under this term Darwin, Weismann, and other supporters of this principle, include animals as low down as the Arthropoda, but the boundary between them and "lower animals" destitute of artistic discrimination cannot but be arbitrary, considering how little we know of their intellectual and emotional capacities. Another thing is no less certain, that sexual dimorphism and complicated ornamental colours continue uninterrupted into lower orders. Thus a different cause must be invoked to explain identity of effect.

Another aspect of the "æsthetic" difficulty is this. Certain secondary sexual characters of "higher animals" are displeasing or inelegant to our eyes. In order to show that their *ugliness* is nevertheless attractive to them, we are asked to call to mind the extraordinary æsthetic notions of many savage tribes of men. Conversely, to prove that *beauty* in widely-separated groups of animals must be a source of gratification to themselves, we need

merely consult our own taste, which admires it. Surely an argument on these lines exemplifies an unsatisfactory process of reasoning.

These are, of course, *primâ facie* objections, and it will naturally be urged that sexual selection is not so much a speculation as an induction from the observed fact that the females of many species possess inexplicable sympathies and antipathies for particular males, —in short, that the "members of either sex prefer those individuals of the opposite sex which are to them most attractive."[1]

This *is* an observed fact, but not altogether fortunate as an argument. It proves too much. Supposing the individuals among the "higher animals" really differed and had differed from time immemorial, however slightly, in their choice of partners, all one can say of "likes and dislikes" is that the more they are exercised by one sex the more they appear incapable of modifying the colouring, structure, voice, etc., of the other. For, after all, the tail feathers of two peacocks are pretty much alike even now, after generations of capriciously-minded peahens have exercised their fancies upon them. It would amount to a truism to add that the less these individual tastes are exercised, the less evident becomes the existence of any "selection" whatever.

A special inconvenience arises in the case of polygamous animals. Certain polygamists, such as the pheasants, do not hold nuptial tournaments or resort to battles with other males. But wherever, as in the majority of cases, such contests "for the possession of the female" (Darwin) take place, it is impossible to speak of voluntary selection on the part of the latter. The two things are mutually exclusive.

If, therefore, the exceptional ornaments of the males are the result of female preference, they must have been acquired in their present magnificence before the polygamous, or combative, habits were contracted. Such a supposition is rendered improbable by the very general correlation that exists between polygamous habits and brilliancy of plumage.

If the ornaments have been gained simultaneously with, or subsequent to, the polygamous habits, they demonstrate that processes other than sexual selection are equally capable of forming some of the most highly-finished male ornaments among the "higher animals." This is exactly what I think has taken place.

It is difficult to estimate the objections which the phenomena of analogous variability oppose to sexual selection. I will mention two instances. (1) A curious style of "decoration" that hardly commends itself to our æsthetic taste, namely, to render conspicuous by bright colouring a particular region of the body, has been ascribed, in the

[1] Romanes, "Darwin and after Darwin," i., p. 380; Darwin, "Descent of Man," pp. 414, 522.

case of certain mammals, birds, and insects, to the effects of female preference. (2) The melanic forms of some butterflies, spiders, lizards, birds, and mammals are also considered, by various authors, to have been sexually selected.

It is incredible enough, after all that has been written to prove the "capricious action of sexual selection, fluctuating element of taste, charm of novelty, etc.," that we should still find the females of different species, families, orders, and sub-kingdoms concurring, during untold ages, and with more than human consistency, in their approval of one particular kind of ornamentation. But it becomes still more incredible—if the word could be made to admit of degrees—in the view of the circumstance that, as regards (1), the same parts are also brightly tinted with certain saurians where it is impossible for the females to see them, and respecting (2), there are dark varieties of other animals that no one has hitherto ventured to attribute to sexual selection. Such are, for instance, the recent and non-adaptive forms of colubrine snakes, "higher animals," like *Zamenis viridiflavus, var. carbonarius*. Our own species furnishes a curiously similar instance. The gradual diminution of the xanthous complexion to the advantage of a darker stock appears to be proceeding in various parts of the world quite irrespective of climatical conditions, and yields, therefore, the strongest presumptive evidence in favour of sexual selection. Here, as in the other instances, the ontogeny shows that the males are the first to become modified. Now, in the case of man, there are exceptional facilities for observation and the *à priori* probability that the æsthetic faculties are more highly developed than in other animals. Still, among the many suppositions that have been advanced to account for this displacement of the fair by a darker type, I can find surprisingly little that suggests the "cumulative action of female preferences."

There are difficulties of another order. Compare the classical case of the argus pheasant with that of man. No doubt the earnestness of purpose and *degree* of estimation with which the females of this bird may regard, for the time being, the objects of their affection may be the same as with us: "*le beau pour le crapaud c'est sa crapaude.*" There is, however, a difference in *kind*. For personal beauty with man possesses a purely extrinsic worth—it lies in the eye of the beholder. But if the argus pheasants, waiving private inclinations in favour of sterner motives, have dispassionately judged, as they must have done, with the eye of connoisseurs and by one unvarying[1] standard the artistic merits of their countless generations of suitors, they have set an intrinsic value on the beauty of the latter. Unless this ideal striving coincides with the greatest physical vigour, it can only be due to the survival of the intellectually fittest.

However that may be, it is no hair-splitting distinction, nor is it

[1] Not "approximately," *Proc. Zool. Soc.*, 1881, p. 368.

exactly what we should expect to find, that while man contemplates personal beauty from a subjective point of view, the "higher animals," as typified by the argus pheasant, take an objective one, and whoever believes in sexual selection must ask himself the question: To what could be attributed their initial differentiation in this respect?

I believe no such differentiation has ever taken place, and that, in speculating on the æsthetic faculties of animals, an important element is apt to be disregarded. Man appears to owe what advance he has made in the refinement of these faculties, in the first instance to his social instincts, to the consequent division of labour and the greater *leisure* derived therefrom. Without leisure no artistic product can be consciously evoked or recognised as such; artistic worth does not exist, much less the taste whereby to criticise it. Whatever may be the potential capacity of mind of the "higher animals," I hold that their time is too preoccupied with the actual struggle for existence to permit of the formation of the mental qualities ascribed to the argus pheasant. These are a luxury to which human savages, some of them, have not yet attained.

Somewhat analogous objections apply to the pleasure supposed to be given by the nuptial flights, antics, and dances of many birds. They are of different kinds. The first are such as the aërial evolutions of rooks in spring-time, which no one would connect with female preferences. The leks of the capercailzie illustrate the other extreme, and are quoted by Darwin in support of his theory. As it has also more recently been stated that "it is impossible to conceive what motive can be in the mind of a cock other than that of making himself attractive, when he performs his various antics, displays his ornamental plumes, or sings his melodious songs,"[1] I may translate a passage in a well-known monograph on the capercailzie to the effect that "the hens are by no means always in the neighbourhood of the cock, who, after his balzing, must often go to a considerable distance after them: it is as if a rendezvous had been arranged beforehand."[2]

If, then, the females do not even trouble to look on, *cui bono?* Besides, I think most sportsmen will have found that the hens do not attend regularly at the beginning of the balz-season, hardly ever at the evening performance, and even if they did, any admiration which they might entertain for the postures of their one lord and master, who will not tolerate rivals in his revier, would seem to be gratuitous.

Strange to say, the higher we ascend into the regions of æsthetic perceptibilities the more hazy the outlook. I cannot bring myself to believe that our fair semi-human ancestors habitually forgot them-

[1] Romanes, "Darwin and after Darwin," i. p. 398; but see also *Nineteenth Century*, 1893, p. 889.

[2] Dr. W. Wurm, "Das Auerwild," pp. 54 and 62.

selves so far as to elect husbands—whether for a season or for life is immaterial—on the strength of their terpsichorean proficiency. What a profligate generation! Yet dancing is an ancient practice and one that, while it "corresponds to a universal primitive instinct in man,"[1] has been brought to a high state of perfection by him. We may hence conclude that if the "higher animals" possess an artistic appreciation of dancing, and if female predilections have fostered the development of this pastime by the selection of the best performing males, and if our early progenitors can be fairly described as "higher animals," such preposterous merry-making is as natural with man as it would be discreditable. More's the pity, indeed, that female preferences should produce so little that is lovely in these latter days.

So insensible are the gradations existing between the simplest and the most complex of these phenomena of nuptial flight or dance, that I am driven to the conclusion that gestures and gambollings of all denominations throughout the various orders of saltatory nature—from the "unusual antics and gyrations"[2] of worms up to the contortions performed by the gilded youth in modern ball-rooms—will ultimately be found to be only the outcome of that unfortunate "surplus vitality" which is no nonentity, but a factor to be taken into account. Here lies, indeed, the root of the whole matter. For surplus vitality is another name for the primary physiological processes that supply the material (be it colour, or structures, or exuberant activity, or song) whose subsequent elaboration, as incompatible with the principle of utility, is entrusted to female preferences.

A curious parallel could be drawn between the evolution of the human arts of dancing and music. Neither of them, I think, have the origin ascribed to them in the "Descent of Man" or the "Expression of the Emotions." The infantile and savage delight derived from the mere repetition of musical sounds stands on a level with the unpremeditated caperings indicative of high spirits in the young of many animals, including man. But after some time their dormant complexities are stirred up and rendered subservient to a variety of ends. Thus arise purposive specialisations, such as warlike music, religious dances, etc. Certain forms of both these arts are purely erotic, or "decorative." Yet there is nothing to warrant the belief that either their origin or any successive stage of elaboration is due to predilections on the part of the female sex.

In this connection, one or two points in Darwin's chapters on "Sexual Selection in Relation to Man" may be noticed.

It is generally accepted that among savage tribes the men pay quite as much attention as the women to their tattooings, coiffures,

[1] Mrs. Grove, "On the Ethnographic Aspect of Dancing." The taste for dancing, doubtless, like other characters originally confined to the male, will have been gradually transferred to the other sex. Even now among savage nations it is the males who principally indulge in this sport.

[2] Beddard, "Animal Coloration," p. 268.

plumes, etc.—if not more. It is not merely an exemplification of a law of development that the fair sex should hesitate to abandon a prehistoric caprice of this description which civilised men of the present day have discarded, for this fact also throws a light upon the question of female preferences in past ages. Let us suppose, for a moment, contrary to the Darwinian hypothesis, that the diversified attractions of savage men are not the result of a long-continued process of sexual selection in earlier times. If so, how does it stand with the well-trimmed tufts of hair and the decorative ridges in the face of some of the quadrumana, whose similarity to human modes of embellishment is not fanciful, but real, and expressly insisted on by Darwin (pp. 541 and 549 *seq.*)? If preferential mating has not produced the ornaments of monkeys, birds and other animals will be able to dispense with it still more easily. Granted, on the other hand, that the ornaments of man have been sexually selected like those of all "higher animals," it follows that the women of those early days were able to exercise a free choice, notwithstanding the servile condition in which they are frequently presumed to have existed. Passing over this difficulty, however, it is surprising to find it implicitly and explicitly stated throughout these chapters that the order of selection in the case of man is generally reversed, the males choosing the females.

Now, what does this entail? Nothing less than that the fair sex of our species stands acquitted of any initiative in the appreciation of useless male embellishments. This may be gratifying to the majority of mankind, but the defender of sexual selection is landed in a greater dilemma than ever, for its agency is rendered incompetent, on the expressed opinion of its author, to account for male ornamentation in a species where one might reasonably presuppose the highest development of æsthetic taste on the part of the female sex. By raising a strong presumption against the efficacy of preferential mating in less highly organised groups, this constitutes one of the gravest defects of the theory.

Another difficulty. If promiscuous intercourse and the low estimation in which women are held form two of the four chief causes that prevent or check the action of sexual selection with savages (p. 587), they cannot fail to interfere with its influence in the case of all "higher animals."

Again, respecting the absence of hair on the body of man, Darwin states that "we may reasonably suspect this character to have been gained through sexual selection" (p. 600). Still, if our female semi-human ancestors were the *first* to acquire it (pp. 57 and 601), and afterwards "transmitted it almost equally to their offspring of both sexes while young," there is surely no necessity to invoke sexual selection in order to explain its *subsequent* appearance with the males. And if the peculiarity be due to the action of male preferences of one sort or another, we must extend this explanation to certain of the anthropoid apes, the females of which are also somewhat less hairy

than the males. Where, then, should male selection end and female selection begin?

I also venture to doubt whether the jet-blackness of the negro's skin (pp. 195 and 604) that is acquired by the young of both sexes at a comparatively early age can have other than a purely physical origin.

So much for our progenitors. Darwin hardly touches upon the question of sexual selection of the present generation, though he testifies to the gravity of the problem. But it requires no great reflection upon the conditions of modern life to convince oneself that the female members of the human race are not, as a rule, in a position to gratify their fancies in this matter. And if we take the example of an exceptionally situated individual, we find that her choice among a number of suitors is determined, at the last moment, by the most unexpected circumstances, and that she selects, after the decease of her elected partner, another one, different in every single respect. The same applies, *mutatis mutandis*, to the male section of the community.[1]

I am not concerned with the ethical aspects of this fact. For the anthropologist it is sufficient, but essential, to note that even in our own species the possession of "likes and dislikes" implies anything but that of a permanent ideal. If this be so, it becomes difficult to conceive how any definite style of ornamentation[2] could have been perpetuated through æsthetic preferences on the part of either sex.

Having cleared the way by a consideration of some miscellaneous objections, I shall proceed, in the second half of this article, to discuss the problem as exemplified in a single species, *Lacerta muralis*.

G. Norman Douglass.

(*To be continued.*)

[1] No doubt our prognathous ancestors were less distracted by social considerations, but there is no reason for crediting them with more constancy of taste as regards personal appearances. It stands to reason, also, that human nature will have been prejudiced at all times against actual disfigurement or semblance of ill-health, but this is irrelevant to the question of choice between physically sound individuals.

[2] I have avoided making any distinction between natural and artificial ornamentation, as none is made in the chapters before me.

IV.

The International Congress of Zoologists.

THE third International Congress of Zoologists, which came to a conclusion on Saturday, September 21, at Leyden, must be considered to have been a very great success.

At the two previous meetings, held in Paris and Moscow, the French language was the only one that was allowed to be used in the general and sectional assemblies, and this restriction undoubtedly gave them a distinctly French and Russian bias. At Leyden it was arranged that the speeches should be delivered either in French, German, or English. The ball was set rolling by Professor Hubrecht, who, in a brilliant speech commencing in French, proceeding in German, and concluding in English, welcomed the members of the Congress and gave a truly international flavour to their deliberations.

A great many of those present felt that it was a pity that England and Germany were not more fully represented, but the meeting at Leyden must be regarded as indicating a change towards real internationalism in zoology, which it is to be hoped will be still further emphasised when the Congress meets in England in 1898.

The reception given to the zoologists by Holland was in every sense a royal one. The beautiful young Queen and her mother, the Queen-Regent, graced one of the most brilliant meetings with their presence; the quiet but interesting old town of Leyden was gaily decorated with bunting during the week, and the railway companies, the clubs, and many private individuals in the city and its neighbourhood were lavish in their hospitality.

With such a reception the Congress was bound to be an extremely pleasant meeting. I feel quite sure that zoologists of all nations who visited Leyden in September will look back upon this Congress for many years to come with gratitude and pleasure. But, apart from its great social success, the Congress this year will be memorable from a purely scientific point of view. At the opening meeting, the address of Professor Weismann on the principles of Natural Selection was regarded, by those who were near enough to the speaker to hear him, as a remarkable and interesting chapter of his philosophical work. Many of the ideas he expounded for the first time on this occasion will doubtless meet with a great deal of criticism when they are published; and, indeed, Professor Eimer, of Tübingen,

found occasion at one of the sectional meetings to pass some severe comments upon them; but the general tone of the meeting showed unmistakably that the philosophy of the distinguished Geheimrath from Freiburg has made a profound impression upon the zoologists of all nations, and is followed by most of them with interest and respect.

The address delivered by Professor Milne Edwards on the resemblances between the fauna of the Mascarene Islands and that of certain islands in the Pacific Ocean, and Mr. John Murray's lecture on the results of deep-sea exploration, were both delivered at general meetings of the Congress, and were listened to with marked interest by large audiences.

In nearly all the sections, interesting and important papers were read by zoologists whose names are familiar to men of science throughout the world, and it was often very difficult to determine to which of four or five celebrated men who were due to speak at the same hour in different rooms it would be most profitable to listen.

The most distinguished audience of the sectional meetings was, however, reserved for the last day, when Dr. Dubois exhibited his fragments of the new "missing link," or *Pithecanthropus erectus*, as it is called. It is not surprising that the young doctor from Java showed some signs of nervousness in reading his paper in the presence of such eminent anthropologists as Virchow, Flower, Rosenberg, Marsh, and others, but he came through the ordeal well, and was highly complimented on his success. The fragments consist of a femur, the vault of a skull, and two molar teeth. The general impression gained from the discussion was that the femur, which showed marked signs of pathological change, might possibly be human, but that the fragment of skull was more ape-like than any human skull hitherto known to science, and consequently belonged to an animal as nearly corresponding with the long looked-for missing link as we may expect to find. One very interesting point which was brought out very clearly by the remarks of Virchow, was that the characters of the skull approached more nearly those of the Gibbons than of any of the other anthropomorphic apes.

But, in addition to the purely scientific work of the Congress, some important conferences took place upon what may be called the organisation of zoological literature.

It has been well known to zoologists for some time past that an important project is in progress for supplying men of science with complete lists of books and papers that are published from a central "bureau" or office. The general plan and the details of the project have been carefully worked out by Dr. H. Haviland Field, a well-known writer on embryological subjects. The proposals have already met with a hearty approval from the editors of the *Zoologischer Anzeiger* and *Zoologischer Jahresbericht*, and from most naturalists on the Continent and in America. In England alone has the scheme

met with any serious difficulties, and these difficulties were not, to say the least of it, removed at the meeting of the British Association at Ipswich when the matter was discussed.

It is interesting to note, therefore, that when the scheme was introduced by Professor Bouvier at Leyden it was received with enthusiasm, and the resolutions pledging the meeting to support its general principles were carried unanimously. It is most sincerely to be hoped that the English opposition will now cease, and that the naturalists of our country will join with their colleagues abroad in giving the proposed bureau their hearty support.

Another important resolution concerning the regulations for the transmission by post of living and dead animals was also passed unanimously.[1]

SYDNEY J. HICKSON.

[1] We have given an account of this resolution in our Notes and Comments this month —ED. NAT SC

V.

The Value of Myology as an Aid in the Classification of Animals.[1]

THE opinion of most systematists, and of anatomists too, is, I believe, that the study of muscles is not of much value for classificatory purposes; first, because muscles are liable to a good deal of individual variation; secondly, because they are often difficult to identify by those who are not specially working at them; and thirdly, because of the impression that the arrangement of the muscles depends largely on the habits and mode of life of the animal to which they belong.

With regard to the first objection, that muscles are very variable, Dobson in 1884[2] stated his opinion that the muscles of the lower wild mammals do not show anything like the same proportion of abnormalities that are met with in man. This opinion my own experience bears out, although I am bound to confess that variations do occur fairly often. Still, if several muscles are taken, the risk of any serious inconvenience from this source is small.

The second objection is not a very serious one. Nobody wishes to lay any stress on slight differences of size or attachment, but rather on the presence or absence of muscles, and on the shifting of their attachments from one bone to another.

The third question, namely, the extent to which muscles vary with the mode of life of their possessor, is the one which I wish to consider most fully. I propose to put forward certain facts gathered from a study of the muscles of the great Order, Rodentia, an Order which contains climbing, swimming, digging, running, and, in a sense, flying forms. Thus I hope to substantiate my contention, that the muscles of an animal tell much more about its classificatory position and the habits of its ancestors than about its own present habits.

One of the most interesting points in the myology of rodents has already been discussed by Dobson[3]; it is the relation which the two long flexors of the sole bear one to the other. These two flexors are spoken of in human anatomy as the "flexor longus hallucis," which

[1] Paper read before Section D of the British Association, Ipswich, 1895.

[2] *Journ. Anat.*, xix., p. 16.

[3] *Journ. Anat.*, xvii., p. 142.

rises from the fibula, and the "flexor longus digitorum," which comes from the tibia. As these names are quite misleading when applied to the lower animals, Dobson has very wisely suggested the terms "flexor fibularis" and "flexor tibialis," respectively. In the whole of the sub-order of the Hystricomorpha, or porcupine-like rodents, these two tendons join in the sole; in the squirrel group, or Sciuromorpha, they do not join, but the flexor tibialis is inserted separately into one of the tarsal bones. In a specimen of the flying squirrel (*Pteromys oral*), I found the flexor tibialis dividing, one half joining the flexor fibularis, while the other had the insertion usual in Sciuromorpha. The mouse-like rodents (Myomorpha) are placed by the systematists nearer to the squirrels than to the porcupines; consequently one is not surprised that the long tendons are arranged as in the former animals. I have, however, been somewhat interested to find two exceptions, the bamboo rat (*Rhizomys badius*) and the pocket mouse (*Heteromys longicaudatus*). One of the most curious things is that the jerboas have the tendons united, and in this respect approach the Hystricomorpha. Dobson lays the greatest stress on the value of these tendons as an indication of natural position among the rodents; but I am inclined to think that they should be used carefully and only in conjunction with other muscles. It is largely owing to the arrangement of these tendons that Dobson claims a place for the Dipodidæ among the Hystricomorpha, but I have just been able to show that among the Myomorpha a similar arrangement exists in *Rhizomys* and *Heteromys*. To this question of the position of the Dipodidæ I return later.

Another noteworthy muscle is the "sterno-scapularis." This consists of two parts: one running from the first rib, at its junction with the sternum, to the clavicle, and corresponding entirely to the human subclavius; the other reaching from the clavicle over the supraspinatus muscle to the spine of the scapula. These two parts are often continuous beneath the clavicle, and are supplied by the same nerve. The first part, the "subclavius," is always present; the second part, the "scapulo-clavicularis," is never found in the Sciuromorpha, but was present in every specimen of the Hystricomorpha examined, with the exception of the jerboas, whose position is still unsettled. The hare-like rodents (Lagomorpha), as one would expect, resemble the Hystricomorpha in the presence of the muscle, while the Myomorpha approach the Sciuromorpha in wanting it. Among this latter group, however, are two exceptions in which it is present; namely, the African mole-rats, *Bathyergus* and *Georychus*. The former of these has already been suspected of affinities with the Hystricomorpha on account of the structure of its mandible, and it is interesting to notice how the muscle seconds the testimony of the bone. The action of this muscle must be to lessen the angle between the clavicle and scapula, and so to make the glenoid cavity face more downwards. This action is, doubtless, most useful in digging, and it

may be urged that the presence of the muscle in these subterranean forms depends more on their mode of life than on their relationship. Against this view I would urge the case of the mole-rat, *Rhizomys*, which is also subterranean, yet which does not possess the muscle, and also the fact that the muscle is found in all the Hystricomorpha, including animals such as the tree-porcupines, the agoutis, and the cavies. It is interesting to turn aside for a moment to speculate on the methods by which this muscle might appear or disappear. Only two occur to me: first, that it is a delamination from the subjacent supraspinatus; secondly, that it has been formed by the conversion into muscle of the fascia over the supraspinatus, by the encroachment of fibres from the subclavius. In favour of the latter, and against the former, hypothesis are the facts that the muscle is often continuous with the subclavius, and that it is supplied by the same nerve and not by the suprascapular nerve, which supplies the supraspinatus.

Both the muscles already selected as examples tend to show that the myomorphine arrangement is more closely allied to the sciuromorphine than to the hystricomorphine and lagomorphine. It is not difficult to find other examples of this. For instance, the small transverse mandibular muscle, which unites the two halves of the lower jaw close to the symphysis, is present in the Sciuromorpha and Myomorpha, absent in the Hystricomorpha and Lagomorpha.

The scapulo-clavicularis is an instance of a muscle which is not found at all in the Sciuromorpha, is always present in the Hystricomorpha and Lagomorpha, and is very rarely seen in the Myomorpha. I will next give instances of muscles which are present in the more generalised squirrel group, and are gradually lost as we ascend to the more specialised. The above-mentioned transverse mandibular muscle is one instance of this; another is the omo-hyoid, which is always present in the Sciuromorpha and Myomorpha, but is absent in certain families of the Hystricomorpha, such as the Chinchillidæ, Dasyproctidæ, and Caviidæ. In the Hystricidæ it is absent in the ground-porcupines *Hystrix* and *Atherura*, but present in the tree-porcupines *Sphingurus* and *Erethizon*. In the Lagomorpha the muscle is absent in the hare and rabbit.[1] The presence of the omo-hyoid in the tree-porcupines and its absence in the ground-porcupines may certainly be regarded as an instance of change of musculature accompanying change of habits, more especially as there is, so far as I am aware, no arboreal rodent which does not possess an omo-hyoid. My object, however, is not to prove that this never occurs, but rather to show that, in spite of it, many muscles vary very constantly with the relationships of the animals that possess them, and may be advantageously considered in classification.

Another muscle on which I am inclined to lay a good deal of

[1] I have, unfortunately, never had the opportunity of dissecting a *Pica*, the other genus of this suborder, nor can I find any account of its myology.

stress is the "supinator longus," a muscle that tends to disappear on very slight provocation. It is present in all the Sciuromorpha that I have examined, with the exception of the beaver; that is to say, it is present in the squirrel, the flying squirrel (*Pteromys*), the ground squirrel (*Xerus*), the marmot, and the gopher. I am unable to say whether it is found in the families of the Anomalures and Haplodonts as I have never had an opportunity of dissecting examples of these, and can find no records of such dissections; but there is no doubt that the muscle is a very common one among the generalised squirrel sub-order. In the Myomorpha it is not found at all. Among the Hystricomorpha I have never seen it, but I find an account of it in tree-porcupines, dissected by Mivart[1] and Windle.[2] In the Lagomorpha it is also absent. It may be said that this is a muscle which depends very much on the climbing habits of its possessor, and in a certain sense this is true; but the point on which I wish to lay stress is that the marmot, which does not climb and is a near relative of the squirrel, has a well-developed supinator, while the tree-porcupine, *Sphingurus*, has no trace of it—indeed, in Windle's specimen of *Erethizon* it was quite rudimentary. If further evidence be needed that its presence does not necessarily imply climbing, one may point to the fact that it is present in the jerboas, three different species of which I have examined.

The supinator longus is also valuable in the Carnivora, for it is present in the Felidæ, Procyonidæ, and Ursidæ, but absent in the Hyænidæ and Canidæ. It is more important, however, to notice its distribution in the rodents; since some authors, even in books of reference, have stated that it is absent in this Order.

It is not only the presence or absence of certain muscles that varies with the classificatory position of animals; the attachments are also valuable. A good instance of this is the "levator claviculæ" or acromio-trachelien; in the Sciuromorpha and Myomorpha this always rises from the atlas, while in the Hystricomorpha it is most inconstant, in some cases rising from the atlas, and in others from the basioccipital. It will be a good test to pick out those animals in which this change of origin has been effected, and to see whether there is any marked similarity in their mode of life which might account for it. The animals in which I have found the basioccipital origin are the African ground rat (*Aulacodus*) which inhabits cane-brakes, the hutia (*Capromys*) an arboreal form, the coypu (*Myopotamus*) which is aquatic; the ground-porcupines (*Hystrix* and *Atherura*), and the spotted cavy (*Coelogenys*) which are terrestrial forms, as well as three genera of the family of Caviidæ (*Cavia*, *Ceredon*, and *Dolichotis*), all of which are also terrestrial. This list, I think, does not point to the change of attachment being due to any definite change in the animals' mode of life. Hitherto I have only instanced muscles which indicate the sub-order to which the animal belongs; but it would be

[1] *Proc. Zool. Soc.*, 1882, p. 271. [2] *Journ. Anat.*, xxii., p. 126.

quite possible to place a specimen in its proper family by referring to the combinations of muscles which are characteristic of that family. For instance, the absence of a scalenus anticus in a hystricomorphine rodent would at once make me suspect that it was a porcupine; if it wanted a peroneus quarti I should suspect it of being a tree-porcupine; and if in addition it had two heads to the biceps cubiti, a well-developed omo-hyoid, and a levator claviculæ rising from the atlas, I should feel pretty certain that it was one.

The question which I should expect to be asked, and which, indeed, has been asked, is "What light does myology throw on the position of the Dipodidæ?" Dobson[1] says that the only argument for placing them among the Myomorpha is the fact that the tibia and fibula are fused, while in favour of including them in the Hystricomorpha are the united flexors in the sole, the masseter passing through the infraorbital foramen, the external appearance of the ears and muzzle, the armed condition of the penis, and the arrangement of the teeth.

With regard to the fused tendons, I have been able to point out two examples of myomorphine rodents in which these are present. The large size of the infraorbital foramen is a question of degree, since in most myomorphine rodents a small piece of the masseter passes through this opening, and it is only in sciuromorphine and lagomorphine rodents that the infraorbital foramen transmits nothing but the nerve. With regard to the classificatory value of teeth, Mivart, in his work on the Æluroidea,[2] has given grounds for not placing much confidence in them, and, for my own part, I cannot help thinking that, unless used with considerable caution, they are apt to mislead. I can add another claim to those which Dobson has given for regarding the jerboas as hystricomorphine, and that is that they have only one head to the biceps cubiti, while every myomorphine rodent that I have looked at possesses two. On the other hand, in addition to the fusion of the leg-bones, which is never seen in the Hystricomorpha, the two halves of the lower jaw move upon one another and are provided with a transverse mandibular muscle; the digastric is arranged on the sciuromorphine type described by Kunstler,[3] a type which is never found in the Hystricomorpha, but often in the Myomorpha; the scapulo-clavicularis, which I have already laid stress on as being a most constant muscle in the Hystricomorpha, is absent; and the omo-hyoid is present as in all the Myomorpha, while it is often absent in the Hystricomorpha. On the whole, I certainly think that the myology of the jerboas points to their having myomorphine rather than hystricomorphine tendencies, though their many points of difference from both groups might entitle them to subordinal rank, as Dipodomorpha. With regard to the affinities that Dobson believes them to have with the Chinchillidæ, a

[1] *Proc. Zool. Soc.*, 1882, p. 640. [2] *Proc. Zool. Soc.*, 1882.
[3] *Ann. Sci. Nat.*, ser. 7, t. iv., p. 150.

study of their muscles negatives the idea entirely. In addition to the scapulo-clavicularis and the digastric and transverse mandibular points of divergence, the Chinchillidæ have two heads to the biceps cubiti, the jerboas only one; in the Chinchillidæ the biceps is inserted into both bones of the forearm, in the Dipodidæ only into the ulna; in the Chinchillidæ the omo-hyoid is absent, in the jerboas it is present; in the Chinchillidæ the tibialis anticus rises from the tendon of the extensor longus digitorum as well as from the tibia, in the Dipodidæ it rises only from the tibia. I am pleased to notice that Winge, in his monograph on "The Rodents of Lagoa Santa" (*E. Museo Lundii*, iii., 1888) separates the Dipodidæ from the Hystricomorpha, but for other reasons than those I have brought forward.

In concluding this paper I must admit that I have founded my generalisations on the study of one Order of mammals; but this is partly because I have paid more attention to rodents than to other animals, and partly because a general review of myological literature would far exceed the limits of a paper such as this. My observations on other animals, as well as a study of the literature of the subject, make me think that what is true for one of the largest Orders holds good for the rest. Attention may be directed to a most complete paper by Wilson on the myology of *Notoryctes typhlops* as compared with that of other mammals, in which the following passage occurs[1]: "I cannot avoid the conclusion that the structural resemblances in particular to certain members of the order Edentata are not all to be explained as merely the coincidences of somewhat similar functional modifications, but are the enduring evidences of a real if distant morphological kinship." This is practically my own view, and I would urge that certain muscles provide a very good clue to the relationships of animals, the great point being to select the muscles on which reliance is to be placed.

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[1] *Trans. Roy. Soc. S. Austral.*, 1894.

VI.

The Rôle of Sex.

APPENDIX.

QUETELET, in his "Anthropométrie de l'homme" (1870) has shown that if the height-measurements of a large number of men are compared with one another, the following very interesting facts may be observed. The greater number of men are of average height, many are just above or just below it, and fewer and fewer are found at heights further and further removed from the average. Not only is this true as regards height, but it is also true of every measurable quality, whether of body or mind, that man possesses. This fact can be represented in the form of a diagram (Fig. 1). Along the horizontal line from A to B mark off equal divisions corresponding to the *inches* between the shortest man, A, and the tallest man, B. Let the vertical heights correspond with the *number of individuals* whose heights are found to be the same. At A, which we may suppose is five feet, there will, perhaps, be but a single man, and the curve will be very low in height at that spot. At the next division, corresponding to 5 ft. 1 in., there will, perhaps, be two men, and the curve will rise. When we have finished constructing the curve, it will be observed that its highest point is in the middle, and that its slopes are quite symmetrical. According to Quetelet, the above statement applies to the measurable qualities of every living species, whether of plants or animals. But, as we shall see, it does not apply to groups of inorganic objects.

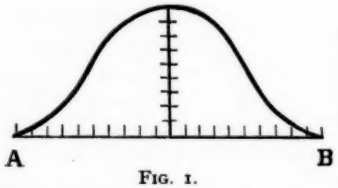

FIG. 1.

So far as I can make out, lakes, mountains, rivers, stones on a beach, crystals growing in a mother liquid, and a hundred other groups of objects, present quite a different curve from Fig. 1. To illustrate this by an example, I give the weights of 327 stones taken haphazard by a spade from the beach. The smaller stones are by far the most numerous, and the highest part of the curve is, therefore, situated at its commencement (Fig. 2). Thus it appears that the symmetrical curve showing a convergence towards a mean is characteristic rather of groups of living than of non-living bodies.

Francis Galton,[1] who has investigated man's mental qualities by the same method that Quetelet used for his physical qualities, would

[1] "Hereditary Genius," pp. 26, 27, and 29.

amend Quetelet's statements in one important particular. While Quetelet thought that we might represent by a simple symmetrical

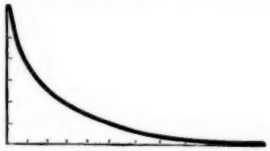

FIG. 2.—Weights of stones from a beach.

0– 5	grammes	=	149
5–10	,,	=	90
10–15	,,	=	28
15–20	,,	=	20
20–25	,,	=	18
25–30	,,	=	9
30–35	,,	=	4
35–40	,,	=	5
40–45	,,	=	3
45–50	,,	=	1

curve the qualities of a group of individuals called by us a "species," Galton insists that free interbreeding between members of that group is a necessary condition, without which the curve will not preserve the same proportions. Now, free interbreeding does not occur between different races, and as Galton remarks on p. 29, "it clearly would not be proper to combine the heights of men belonging to two dissimilar races in the expectation that the compound result would be governed by the same constants." Venn[1] illustrates this by an attempt to mix the heights of the taller English with those of the shorter French race. He says, "If we mix up the French and English heights what will follow? Beginning from the English mean of 5 ft. 9 in. the heights will at first almost entirely follow the law determined by the English conditions, for at this point the English data are very numerous, and the French by comparison very few. But as we begin to approach the French mean the numbers will cease to show the continual diminution which they should according to the English scale of arrangement, for here the French data are in turn very numerous, and the English by comparison few." The result of such a combination of heterogeneous elements is illustrated by Fig. 3 (of course in an exaggerated form.)

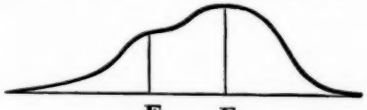

FIG. 3.—French and English.

FIG. 4.—Pugs and St. Bernards.

More striking still would be the compound curve which would result were the heights of the Bushmen and the Patagonians mixed together, or even a more extreme example still, the heights of pugs and St. Bernard dogs. Here we are dealing with two races or breeds of the same species, with two groups of individuals which at one time interbred, but which are now separated from each other, and as a result of selection have become vastly different. In these cases the two curves are not superimposed at all, but lie far apart, for the largest pug is smaller than the smallest St. Bernard. (Fig. 4.)

The simplicity and symmetry of the curve of any measurable

[1] "Logic of Chance," 1876, p. 40.

quality taken from a group of individuals will, therefore, be a test of interbreeding, and we shall be able to say, after the inspection of such a curve, whether or not the individuals measured belong to one or more interbreeding groups; this method of inquiry has already been put in practice and is yielding very valuable results. (See NATURAL SCIENCE, vol. vi., pp. 217–221.) Now interbreeding is essentially a result attainable by sexual intercourse alone, for the products of asexual reproduction are offspring which start on deviating lines, and never mix their qualities with their mates, so long as asexual multiplication continues. Only in those groups of individuals which interbreed by sexual union do we find that the mass of the progeny tends towards the mean or average, and as Galton in his later work, "Natural Inheritance," has insisted, the progeny of a sexual union approaches even nearer to the mean type or mid-species than does the mid-parent itself.

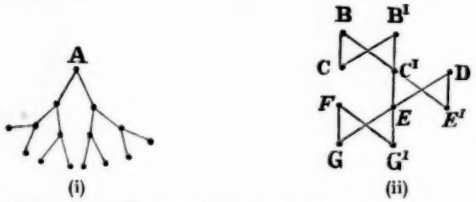

FIG. 5.—Diagrams to illustrate (i) asexual and (ii) sexual reproduction: (i) An individual, A, divides into two, these into four, and these into eight individuals. No interaction between individuals occurs. (ii) Two individuals, B and B¹, unite and produce C and C¹. C¹ unites with another individual, D, to produce E and E¹, E unites with F to produce G and G¹. Constant interaction occurs.

We find, then, that as an actual fact sexual union between members of a group of individuals leads to a convergence towards a mean or average type, and that under constant surrounding conditions this type is preserved. It is curious that those writers who have discussed the utility of sex should have overlooked the results of Quetelet's and Galton's work, for here we find an answer to many of their inquiries. It is true that Quetelet and Galton did not interest themselves in the question from the same point of view that we have taken up: they were more concerned in determining the actual mean, and the law of deviation from that mean. Nevertheless, the facts they gleaned were ready at hand, and obviously bear on this and many other biological problems.

The *convergence to the mean* is, then, a result of sexual reproduction; it may be termed the Rôle of Sex, and one, indeed, of no second order. The tendency constantly to vary is a property inherent in protoplasm, yet often for long periods of time the environment may be the same. In order that a species may continue to live in such a constant environment, the effects of variation must be checked. Sexual multiplication, a conservative function, antagonises the progressive tendency of variation.

J. BERRY HAYCRAFT.

SOME NEW BOOKS.

Birds of Heligoland.

Heligoland as an Ornithological Observatory. By Heinrich Gätke. Translated by Rudolph Rosenstock, M.A. Crown 8vo. Pp. x., 599. Edinburgh: David Douglas, 1895. Price £1 1s.

A most fascinating addition to recent ornithological literature is to be found in the English version of Mr. Gätke's "Birds of Heligoland." The original text, "Die Vogelwarte Helgoland," was published at Brunswick some four years ago, under the sponsorship of Professor Rudolf Blasius; so rapidly was its popularity evinced that, for the last year or two, it has been out of print, and even difficult to procure. Englishmen are notoriously reluctant to take the trouble to read German texts. It was, therefore, a happy thought of Mr. J. A. Harvie Brown to secure the publication of an English edition in this country. Mr. Harvie Brown is not only one of our leading authorities on avian migration, but he has a delicate taste in making books, and is careful to blend artistic illustrations with a severely accurate *resumé* of facts. In the present instance, he enjoyed the coöperation of another accomplished student of migration, Mr. Eagle Clarke, of Edinburgh. At the suggestion of the latter gentleman, the difficult task of translating "Die Vogelwarte Helgoland" was assigned to Mr. Rudolph Rosenstock. Comparisons are apt to be invidious, but we are bound to confess that Mr. Rosenstock has carried out his share of the work with singular fidelity. The labour of revising upwards of 600 pages must have been enormous, and the results reflect the greatest possible credit upon all concerned. The English edition is bound in the usual sage-green cloth affected by that spirited publisher, Mr. Douglas; and it makes an exceedingly handsome volume. Mr. Gätke is essentially a cosmopolitan naturalist. He has specially studied the birds which visit Heligoland, because he had convenient or even unequalled opportunities for doing so. Had his lot in life been cast among the Andes, he would have studied the "Ornis" of the Andes with equal alacrity. The reader who desires to do justice to Gätke's genius must guard against the mistake that Mr. Gätke is merely a local faunist. Mr. Gätke is primarily occupied with *first* principles. Accordingly, he places in the van of his work a series of admirable essays upon topics of such general importance as the velocity of avian flight, the direction of flight, the meteorological conditions which govern avian migration, and allied questions, such as are of universal interest. Gätke may or may not be right in his conclusions, but they deserve the closest examination at the hands of professed experts. The second division of the book consists of a single essay on changes in the colour of feathers. This is extremely suggestive, and might very well have received a more exhaustive treatment. It is only when we reach the third section of the book that we find ourselves really at home with the genial author

For we see Mr. Gätke at his very best upon the island which he has found so fruitful an observatory, and his companionship is felt to be a delightful privilege. Gätke is a painter by profession, and he has a keen perception of the beautiful. He never allows his imagination to run loose. He is too careful a *savant* to do that. But he takes us into his confidences, tells us of the lickings he got as a boy in the Mark of Brandenburg, the escapades of birds'-nesting days, the ambition to paint which drew him to Heligoland, and the many charming *rencontres* with rare birds that have fallen to his lot. Truly marvellous his experience of rare birds has been, unequalled by any of his European contemporaries. Much of his luck in meeting strange birds was due to his intimate knowledge of the literature of the subject; to his great experience in handling skins obtained elsewhere; and last, but not least, to his natural aptitude of eye and ear. But Gätke's enthusiasm was infectious. His zeal provoked zeal. His friendly intercourse with the natives of the island offered many opportunities for his tutoring them to distinguish between one species and another. He taught them what rarities to expect, encouraged them in the midst of failure, rewarded them generously when a rare specimen was brought to him. During the long years of Gätke's watch for migrating hosts of birds, many changes have taken place in their movements. When he was a young man, the shorelark (*Otocorys alpestris*) was hardly known to the island. Nowadays he assures us that hundreds of thousands of shorelarks pass along Heligoland every autumn. He gives us a dainty vignette from nature in his account of the migration of the Golden-crested Wren (*Regulus cristatus*), the "Lütj Müüsk" or Little Wren of the Heligoland folk: "Imagine a mild and clear evening in spring; the sun has set long since and the voices of all the feathered wanderers are hushed in sleep—the last soft 'pitz' of the Redbreast has long since died away, and for some considerable space no sound has disturbed the scented stillness of the air. Suddenly through the silence, like half in a dream, the clear fine note of our little wren is heard, and soon afterwards the bird is seen rising from the neighbouring bushes, through the still luminous evening sky; at measured intervals its call-note—'*hüt—hüt—hüt*'—is heard as it flies off, in slightly ascending spirals, over the neighbouring gardens; then from every bush—here, there, near and far—the cry is answered '*hüt,—hüt, hüt,—hüt, hüt—hüt,*' in loud, clear tones, and from all sides its travelling companions, wakened for the journey, rise upwards, following in the wake of the earliest starter; the latter, however, when the answering voices have announced that all the sleepers are aroused, ceases circling about, and rises with breast erect and brief and rapid strokes of the wings, almost vertically upwards; soon all assemble in a somewhat loose swarm, the call-notes are silenced when the last straggler has joined the departing flock, and the tiny wanderers vanish from sight" (p. 318). It is no exaggeration to say that there are scores of passages equal in beauty to that just cited. Nor should it be forgotten that in some respects Gätke stands *alone*. No other European naturalist shares his knowledge of the habits of the yellow-browed warbler (*Phylloscopus superciliosus*), Richard's Pipit (*Anthus richardi*), or sundry other species of birds. But the volume must be read from end to end to be fully appreciated. Gleams of humour light up its pages when least expected, as when the veteran smacks his lips at the prospect of fat thrushes caught in the throstle-garden, or gives us a sly recipe for making a pie of kittiwakes. Alas! there is also a pathos in the work, for it is the *magnum opus* of an aged worker. We sadly fear that we may hope for no more brilliant essays

from the gifted pen to which already we owe so much. When Gätke penned the preface to the German edition of this work on his seventy-seventh birthday, he proffered the labours of his life as "eine wilkommene Gabe" to his fellow naturalists. It is dangerous to prophesy, but we are firmly convinced that Gätke's unique work will be enormously useful in promoting the study of the why and wherefore of avian migration. Meantime, we thank him with all our heart for the delightful insight that he has given us into "Die Vogelwarte Helgoand."

H. A. MACPHERSON.

SWAYNE'S SOMALILAND.

SEVENTEEN TRIPS THROUGH SOMALILAND. A record of exploration and big game shooting, 1885 to 1893, being the narrative of several journeys in the Hinterland of the Somali Coast Protectorate, dating from the beginning of its administration by Great Britain until the present time, with descriptive notes on the wild fauna of the country. By Captain H. G. C. Swayne, R.E., C.M.Z.S., F.R.G.S. 8vo. Pp. xx., 386, with two maps and 56 illustrations. London: Rowland Ward & Co., 1895. Price 18s. nett.

SINCE the memorable expedition when the two James and Lort-Phillips broke down the barrier of superstition which had so long kept Europeans out of the Eastern Horn of Africa, our knowledge of the country has made rapid progress. Unfortunately, however, most of the work done there has been carried out by shooting parties who have had no time to spare for careful scientific observation, and James's "Unknown Horn of Africa" still gives the best general list of the fauna of the country. We may, therefore, welcome all the more cordially the book of a man who has been engaged in the country for the last eight years, especially as he has been employed in definite work there on behalf of the Indian Government. His maps and reports, which have previously been printed (we wish we could say published) by the Indian War Office, have shown that Captain Swayne is a skilled cartographer and an accurate observer. We therefore turn to this book expecting it to prove a most important addition to the literature of Somaliland. We are not disappointed.

Captain Swayne writes with an intimate acquaintance with the country; his first visit to it was a short shooting trip in January, 1885, followed during the next three years by six journeys in the British Protectorate on Government service. In 1887 he made his first important expedition after big game. His two most daring and important journeys were carried out in 1892 and 1893. In the former year he marched, *viâ* Hargeisa and Milmil, to Gildessa, in order to explore the Abyssinian frontier; he met the Abyssinians, by whom his caravan was surrounded and imprisoned, and it was only by great firmness and tact that Captain Swayne succeeded in avoiding a conflict. He had to leave Gildessa secretly by night, and safely recrossed the Haud to the coast at Zaila. He brought back with him, however, most important news as to the political conditions of the Abyssinian borderland. In the following year he returned to Harar, where he was well received by Ras Makunan, the Abyssinian in command. Later in the same year he crossed the Haud again, but, keeping more to the east, reached the upper part of the Webi Shabéleh (or Shabeyli), which had previously been reached by James's expedition. There he met the Adone, a race of negroes, apparently Bantu. On the way back from this expedition, Captain Swayne, with half the caravan, turned aside into the Golis Range for three weeks' shooting, securing a kudu each week. Almost

FIG. 1.—Henweina Valley, Gan Libah Mountain in the distance. From a photograph by Captain Swayne. The vegetation consists of *Acacia* and *Sanseveira*.

immediately after his return to the coast he again set out on his last expedition, which was a second visit to the Webi Shabéleh, intending to cross this and explore the Galla regions to the south. But the late Prince Ruspoli had just fought his way through that country, and had, as Captain Swayne expresses it, "been singularly unfortunate in the impression left behind." Captain Swayne had, therefore, either to fight his way into the district, or not go in at all, and he chose the latter alternative. Under the circumstances, there can be no doubt that his forbearance has helped to remove the bitter feeling of the Galla of that district against Europeans, and will thus facilitate the future exploration of the country.

After the conclusion of the narrative portion of the volume, Captain Swayne adds a chapter on the fauna of Somaliland, and three appendices, giving instructions on the equipment of expeditions, notes on the physical geography and on the trade of the country. The account of the fauna is an expansion of the author's paper on the Antelopes of Somaliland, published in the *Proceedings* of the Zoological Society, and forms one of the most valuable chapters in the book, containing interesting notes on the habits of the animals. Unlike the accounts of many sportsmen, it is well up-to-date in nomenclature; sometimes it is almost too much so, for the adoption of *Madoqua* without references or explanation may be puzzling to those who know only *Neotragus*, and not having seen Thomas's paper, are not acquainted with the reason for the change. In addition to remarks on the habits of the animals, the author gives some account of the methods in which they are hunted by the natives; among these, the description of the system by which the Midgan capture the ostrich is the most interesting. The value of this chapter is increased by the numerous illustrations; but these are of the conventional type, and of less originality than the sketches of animals at home, which are scattered through the book. These are of unequal value, but the majority are excellent. The figures of animals which illustrate books of travel are usually based on overstuffed museum specimens. Some of Captain Swayne's sketches are rather scratchy and less finished than if they had been executed by a professional artist at home. But they are of far greater value, for they give a good idea of the animals in action. Owing to the courtesy of the publishers, two of them are reproduced here (Figg. 2 and 3); one shows a herd of water-buck (*Kobus ellipsiprymnus*), and the other some *Gazella soemmeringi* at play. Both of these truthfully portray the appearance and gait of the living animals, and show that Captain Swayne has the eye of a true artist.

The full-page photographic reproductions are also very useful, for they give a better idea of the character of the sandy scrub-covered plains of East Africa than any illustrations previously published in England. The only things we know which can compare with them are those issued by Paulitschke. One of them (Fig. 1) has also been kindly lent by the publishers, and shows the sandy, turfless ground, the umbrella-shaped acacias, and the sharp, bayonet-shaped *Sanseveira* (which is unfortunately described as an aloe throughout the book), characteristic of this type of country. The illustrations are so admirable that they often help one to detect errors in the text, for the sections dealing with animals which are not included in the category of sporting game, and with the plants, are not equal to the rest of the book. Thus the rock-rabbits, to which the author refers, are shown by the illustration on p. 256 to be *Hyrax*. He also identifies some trees in the Webi Shabéleh as *Casuarina*, although the occurrence of that genus there is most improbable. He gives an illustration of a rhinoceros at

the pool at Kuredelli (p. 190), and in the background are some trees, which may be those in question; if so, they are probably *Tamarix*. The white bulbs at the base of the thorns of the "galol" (*Acacia* sp.) are apparently regarded as an essential part of the tree, though they are an abnormal growth due to the attacks of ants. The section on the ethnology might also be improved. The use of the term negrito is rather loose, and we regret the absence of more

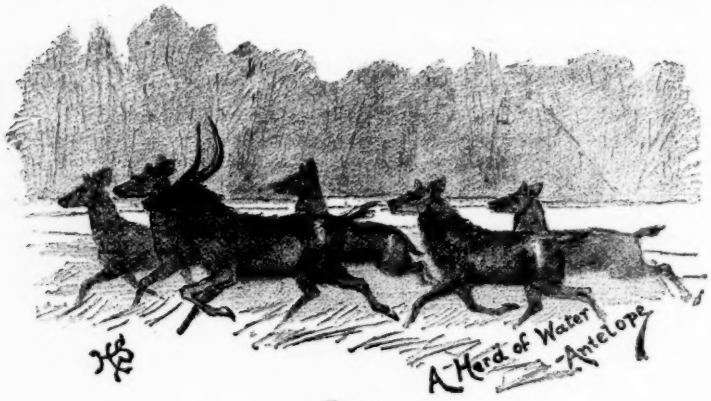

FIG. 2.

definite information about the Tomal and Midgan, two of the most interesting tribes in Somaliland. The author has probably seen more than anyone else of the Midgans, but his account does not solve the problems in connection with their affinities and origin. The author is enthusiastic over the Somali, but he is quite conscious of their failings; he obviously has the power of getting rapidly into sympathy

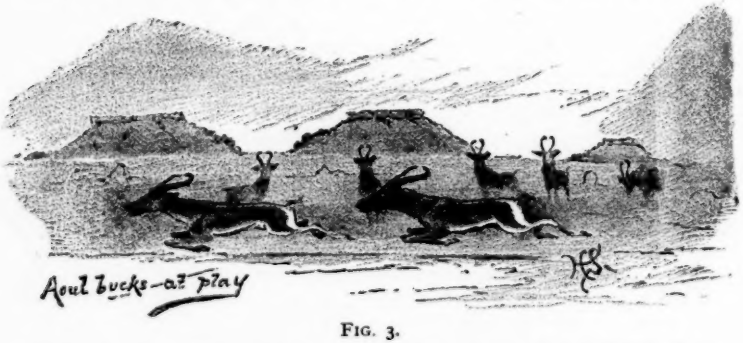

FIG. 3.

with his men, and thus has been enabled to utilise to the fullest their intelligence, pluck, and devotion. But he admits that bad Somali are mutinous, surly, and lazy, and may be cowards to boot; and he justly accuses the Somali as a race with being careless, vain, avaricious, and passionate. He attributes their ostentatious devotion to their prayers simply to a desire to show off. Captain Swayne's account of the Somali is, of course, less complete than that of Paulitschke, but it is the best we know in English. It gives a good account of their

habits and character, but, unfortunately, says less about their physical features. The conclusions which he has arrived at independently in regard to the affinities of the tribe are better than some which he has accepted, apparently somewhat reluctantly, in deference to opinions of men whom he regarded as high authorities.

A few defects and deficiencies in special parts of the book cannot, however, seriously detract from its value and importance; and the author must be congratulated on an important addition to the literature of East Africa. Captain Swayne's work is more business-like and instructive than James's racy narrative; it is more reliable and juster in its judgments than Burton's "First Footprints in East Africa"; and it is more generally intelligible and interesting than the detailed, scientific monographs of Paulitschke. It may be confidently recommended as the best existing account of our new protectorate of Somaliland, of its game, and of its people.

J. W. GREGORY.

SOME RECENT CARCINOLOGY.

REPORT UPON THE CRUSTACEA OF THE ORDER STOMATOPODA collected by the Steamer "Albatross," between 1885 and 1891, and on other specimens in the U.S. National Museum. By Robert Payne Bigelow, Ph.D., Bruce Fellow in the Johns Hopkins University. From the *Proc. U.S. Nat. Mus.*, vol. xvii., pp. 489-550, pls. xx.-xxii. Washington, 1894.

DESCRIPTIONS OF NEW GENERA AND SPECIES OF CRABS OF THE FAMILY LITHODIDÆ, with Notes on the Young of *Lithodes camtschaticus* and *Lithodes brevipes*. By James E. Benedict, Assistant-Curator, Department of Marine Invertebrates. *Proc. U.S. Nat. Mus.*, vol. xvii., pp. 479-488. Washington, 1894.

MORPHOLOGISCH-BIOLOGISCHE STUDIEN ÜBER DEN BEWEGUNGSAPPARAT DER ARTHROPODEN. Von Dr. Theodor List, Mit Tafel xiv.-xviii. und 3 Figuren im Texte. 1. Theil: *Astacus fluviatilis*. Preisgekrönte Beantwortung einer für das Jahr 1894, von der mathemat.-naturw. Abtheilung der Grossh. techn. Hochschule in Darmstadt gestellter Aufgabe. *Morphol. Jahrbuch.*, xx. Bd., 3 Heft. Leipzig, 1895. 2. Theil. Die Decapoden. Mit Tafel 4–6 und 9 Figuren im Text., *Mittheilungen aus der Zoologischen Station zu Neapel*. Band. xii., 1. Heft. Pp. 74–168. 1895.

DR. BIGELOW here furnishes valuable analytical keys to the genera and species of the Squillidæ in general. He supplies figures and detailed descriptions of the fourteen new species which he had already established in 1893. *Odontodactylus*, which in that year he separated from *Gonodactylus* as a subgenus, is here raised to the rank of a genus. He accepts in all nine genera of Squillidæ, whereas H. J. Hansen, in his Stomatopoda of the Plankton Expedition, 1895, reduces the number to seven. But Dr. Bigelow retains the *Leptosquilla* of Miers and the *Pterygosquilla* of Hilgendorf with a hesitation which almost amounts to dismissing them. Hansen includes them both under *Squilla*. The *Protosquilla* of Brooks, admitted as valid by Bigelow, is re-united to *Gonodactylus* by Hansen, who, on his own account, assigns *Pseudosquilla stylifera* (Milne Edwards) to a new genus, *Hemisquilla*.

Under the name of "the Odonterichthus larva," Dr. Bigelow exhibits two forms as probably the young of *Odontodactylus*. The larvæ of Stomatopoda, he says, are sometimes to be found in immense schools. When working at Bimini Islands, Bahamas, in the summer of 1892, he found a few of these larvæ of various kinds and stages almost every time that the towing-net was used; but after dark on three successive evenings in July the towing-nets were crowded with

an immense number of very small specimens of Gonerichthi, the young forms, as it is reasonably supposed, of the genus *Gonodactylus*. Of larval Squillidæ there is a most important discussion in Hansen's work above mentioned. For the adult forms, the student will find Dr. Bigelow's paper of very great service.

Mr. Benedict's paper on the Lithodidæ describes eleven new species, and establishes four new genera.

Several of the new forms seem to be interesting, and the descriptions are no doubt adequate, but there are no illustrations. From a naturalist's point of view, it is almost a calamity to have a new genus instituted without any figures of the typical species. No skill has ever made technical description agreeable reading, so that a new form can only hope for welcome when, by the help of accurate drawings, its distinguishing features can be perceived, if not at a glance, at least without excessive tedium.

Attention should be called to Dr. List's remarkable and amply-illustrated essay on the locomotor apparatus of the crayfish. The ordinary observer will, perhaps, be surprised to find himself confronted in its pages with geometrical diagrams and the formulæ of algebra and trigonometry; but there is much also which the unmathematical reader can follow. For example, the author points out that the last pair of walking feet in the crayfish push, while the three preceding pairs pull, and that the position of the last pair facing the others might lead us to expect a difference in its way of working. But so little, he adds, has this characteristic been taken notice of in the figuring of crayfishes that, even in Huxley's classic monograph, the frontispiece represents the animal in a position which, if it ever occurs at all, is, at any rate, a very constrained one.

Since the above was written, Dr. List has published a valuable Second Part dealing with the motor organs in a considerable number of Macrura and Brachyura. To those who will follow his observations on the living animal, even a common prawn may become an uncommonly interesting object. The circumstance that such an animal has its body-segments (or somites) and its limbs and limb-segments varying in length and strength, in shape and ornament, in mobility and mode of attachment, may easily pass unadmired. But when the nice adaptation of these characteristics to the creature's economy is observed in activity, when, for example, the delicate fore feet can be seen actually taking a mote out of *Leander's* eye, only a churlish insensibility could refuse to be gratified. A human traveller might be tempted to feel disgust at the cumbersome luggage and unportable furniture of his own civilised state, when he finds how compactly and readily a shrimp carries about its person the practical equivalent of brushes and combs, knives and forks, sieves, thread, cement, tongs and shovels, boat-hooks, paddles, and rudder. Dr. List very properly alludes to the admirable observations already made by Dr. C. W. S. Aurivillius on the relations between the seemingly trivial details of structure and the really important necessities of life in various Crustacea. The subject is a wide one, with many interesting opportunities still unexhausted.

In regard to the commonly accepted view that the trunk-limbs of the decapods "consist in the Natantia of seven free joints," Dr. List considers that it no longer has full validity, his investigations having proved that in a series of forms "one joint may be subdivided into a series of 'free' jointlets, which are completely comparable to the other joints." But it may be urged that, in deciding the normal number of segments in the malacostracan limb, one has rather to

consider the origin of the "jointlets" than their acquired character. In passing, it may be noticed that Dr. H. J. Hansen advocates the view that the limb is typically not seven-jointed but eight-jointed. There is apparently no evidence to show what number of segments it started with, but in the present stage of its evolution it would seem to be a matter of convenience to describe it as seven-jointed, although, as I have said elsewhere, it must "be noticed that there are Crustacea in which one or other of the joints, most often the fifth, is itself multiarticulate, thus adding to the normal number, which, on the other hand, is still more frequently diminished by coalescence, absorption, or complete failure of development affecting various parts of the limb."

Were there space it would be pleasant to quote the whole of Dr. List's description of the way in which *Callianassa subterranea* (Montagu) constructs its tunnel in fine sand beneath the water. The relations of form in this eccentric-looking crustacean are, as he says, very unintelligible until eye-witness of its mode of working has shown how its resources, fit though few, result in a truly wonderful piece of architecture. THOMAS R. R. STEBBING.

"I DO PERCEIVE HERE A DIVIDED DUTY."

BRACHIOPODS (RECENT). By A. E. Shipley. BRACHIOPODS (FOSSIL). By F. R. C. Reed. Being pp. 461–512 of vol. iii. of the "CAMBRIDGE NATURAL HISTORY." London: Macmillan, 1895. Price of the volume 17s. nett.

To the section of this volume that deals with Mollusca, and was reviewed in the September number of NATURAL SCIENCE, the chapters now to be considered are in marked contrast. Mr. Cooke's contribution attracts the naturalist by its account of the habits and economy of living animals; the part for which Messrs. Shipley and Reed are responsible will be more welcome to the student of anatomy and palæontology. Of a truth "brachiopods *au naturel*," even when idealised by Bret Harte, hardly lend themselves to a light anecdotal touch, nor do they serve as popular illustrations of the wonders of nature. The Cambridge naturalists have therefore sought—and what is more, have found—their success in a clear and up-to-date exposition of the Morphology, Embryology, Ontogeny, and Phylogeny of the group. Hard words, my masters! but they break no bones, and in the hands of Messrs. Shipley and Reed are not so terrible as the amateur might think. The subject is still further elucidated by figures as superior to the ordinary clichés as were those of the Mollusca; among them the sagittal section of *Cistella* (p. 470) and the view of *Spirifer* (p. 501) are specially to be commended. It does not detract from the value of the former figure that Mr. Shipley cannot make up his mind whether *Cistella* is a subgenus of *Argiope* (p. 472, top line), or *Argiope* a subgenus of *Cistella* (fig. 314, legend, and p. 479), or whether *Cistella* and *Argiope* are two independent genera (pp. 470, 479, 487). A "mere systematist" would tell Mr. Shipley that the name *Argiope* belongs to a spider, and that the brachiopod species mentioned under that name have been referred to *Cistella*, with the exception of *Argiope decollata*, which is a *Megathyris*. Similarly, Mr. Reed! *Magellania* is not a subgenus of *Waldheimia*; what you meant to say was *Magellania* (olim *Waldheimia*) *flavescens*. These things are trifles, but the editors of the "Cambridge Natural History" should remember that they cause the wicked to blaspheme.

I have had occasion, in the course of other duties, to read these chapters with great care, and, though there are a few slips, I am glad of this opportunity to praise the accuracy of detail and the use made of recent writings. None the less do I consider that the work is to be condemned, and that an admirable opportunity has been passed by. If the whole subject of the Brachiopoda cannot be dealt with by any single one of the Cambridge morphologists, by all means let us have two of them. But that is no reason why we should have two accounts of shell-structure, two of ontogeny, two of classification; still less why the two accounts should be at variance with one another. One can only suppose that here is some deep-laid plot to reduce to an absurdity the severance of Recent from Fossil forms. For in this case it is not merely wrong; it is ridiculous. Mr. Shipley tells us that in the Ecardines "the shell is chitinous, but slightly strengthened by a deposit of calcareous salts": Mr. Reed tells us that the Trimerellidæ, which he places in the Ecardines, "have heavy, thick calcareous shells." Mr. Shipley puts his "*Argiope*" and "*Cistella*" into the Terebratulidæ: Mr. Reed constructs a separate family for them. Mr. Reed gives an account of the phylogeny, which is based primarily on features of embryonic development in living Brachiopoda: these features are not even alluded to in Mr. Shipley's account of the embryology. The difference between Cambrian and Recent forms is perhaps less in the Brachiopoda than in any other group of the Metazoa; yet, were it not for the recurrence of a few names, the general reader might well imagine that two quite distinct groups were here being described.

Now consider what might have been done. These two learned and lucid writers might have joined forces; they might have given us an account of the anatomy that should not be self-contradictory; they might have discussed the ontogeny of both fossil and living brachiopods, showing how the former explain the latter; they might have told us the fascinating story of the evolution of the Brachiopoda, from the Cambrian down to the present—the story that Darwin longed in vain to hear, that Davidson himself could not tell, since the key to its hieroglyphics was reserved for Beecher to find. And when they had done this, they might have given us a classification (not two classifications) which should be a summary of the whole history and relationships of all Brachiopoda, living and extinct. That is what we might have had. That is what Hall and Clarke have given us. But the tale as told by Messrs. Shipley and Reed is "full of sound and fury, signifying nothing."

F. A. Bather.

A New Work on Geographical Distribution.

Cambridge Natural Science Manuals. A Text-Book of Zoogeography. By Frank E. Beddard, M.A., F.R.S. Crown 8vo. Pp. vi., 246, with 5 maps. Cambridge, 1895. Price 6s.

Students must often have wished for a book on the geographical distribution of animals giving the leading principles and the main illustrative facts of that most fascinating branch of natural science without the wealth of detail to be found in Dr. Wallace's classical volumes. This want Mr. Beddard comes forward to supply. Admittedly founded largely on Dr. Wallace's writings and on the excellent smaller books on the same subject by Professors Heilprin and Trouessart, the present work contains a fair proportion of matter not found in these, especially with regard to the distribution of various

invertebrates. The plan of the work can be thoroughly commended. The opening chapter deals with the general facts of distribution, giving instances of wide, discontinuous, and restricted ranges, and sketching the distribution of certain selected groups of vertebrates and invertebrates. In compiling his facts as to reptiles, Mr. Beddard makes use of Mr. Boulenger's recent British Museum catalogues. Summaries of the distribution of earthworms and land planarians are specially welcome; and the main results of Mr. Pocock's paper in NATURAL SCIENCE (May, 1894) on the distribution of scorpions are set forth, though it is unfortunate that Mr. Beddard's remarks on the Buthidæ seem to suggest that the archaic character of a pentagonal sternum is usual in that family instead of exceptional. In his chapter on Zoological Geography, Mr. Beddard adopts the well-known six regions of Sclater. It is surprising to find here that the only alternative suggested to the retention of the Palæarctic and Nearctic Regions is the adoption of Heilprin's Holarctic Realm comprising the two. In the concluding chapter, however, a reference to Hart Merriam's proposed Boreal and Sonoran Regions (*see* NAT. SCI., July, 1894) is to be found. Mr. Beddard furnishes under each region and sub-region a concise list of the peculiar and most characteristic vertebrates. He also gives some useful illustrations of graphic methods for indicating the main facts of distribution without maps, by means of lines arranged to form spaces roughly approximating to the relative positions of the various regions.

The third chapter is devoted to the causes influencing distribution; and here the author discusses what physical features serve as barriers to the extension of various animals and what means special groups have of migrating from country to country. The earthworms are again used in illustration, and Mr. Beddard's remarks on their transmission by human agency are of special interest. In the coast regions and near the towns of tropical countries, European species abound, while in the interior the true indigenous worm-fauna is to be found. In this chapter there is also an impartial summary of the evidence for and against the permanence of oceanic and continental areas. Considerable space is devoted to a discussion of the supposed former northward extension of the Antarctic Continent, and the evidence in favour of such a view to be derived from the presence of identical genera of earthworms (Acanthodrilidæ) in New Zealand and Patagonia is stated with much force. From his review of the facts for and against "Lemuria," it appears that Mr. Beddard does not share Dr. Wallace's absolute disbelief in that much-disputed hypothetical tract. The fourth chapter deals with the fauna of islands, and necessarily recalls "Island Life." The animals of the British Isles, Madagascar, the Galapagos, and New Zealand—all dealt with by Dr. Wallace—are briefly sketched, but new examples of oceanic islands are given by Mr. Beddard in Fernando Noronha and Kerguelen. The sketch of the former—an archipelago not quite 200 miles off Brazil—is summarised from a report by Mr. Ridley, and its fauna shows West Indian affinities, though the winged forms have a South American facies. With regard to the animals of Kerguelen, Mr. Beddard points out their poverty in numbers but their wealth in peculiar forms. Some general remarks on the characteristics of island animals conclude the chapter, from which the author surmises that there is a tendency in such forms to darken in colour.

The section on the British fauna is unsatisfactory. The reader would conclude from Mr. Beddard's remarks (p. 185) that the extinct "Large Copper" butterfly (*Polyommatus dispar*) was confined to Britain,

whereas its variety *rutilus* has a wide continental range. We read also (p. 186) that "a black slug spotted with yellow, *Geomalacus maculosus*, was discovered on the shores of Lake Caragh, in Kerry, in the year 1842, and has not been met with elsewhere since that year." More than twenty years ago Heynemann recorded this species from Portugal, and recently its known range in the south-west of Ireland has been considerably extended. This error is specially unfortunate, as the occurrence of the slug in both Portugal and south-west Ireland is far more suggestive and interesting than if it were found in the latter country alone. It is hard to understand how Mr. Beddard can have been betrayed into these statements, as the facts about both butterfly and slug are correctly given (pp. 347, 357) in the last edition of "Island Life," although Dr. Wallace, by some oversight, includes *G. maculosus* in his list (p. 356) of peculiar British species.

Possibly the book has been somewhat hastily compiled; the name of the Liberian hippopotamus (p. 100) is given as *Chœropotamus* (a genus of Eocene ungulates) instead of *Chœropsis*, and we are told (p. 89) that "a great many of the [Palæarctic] mammalia are either specifically identical with North American forms or are very near indeed to them. The Aurochs and the Wapiti are hardly, if at all, specifically different from Luhdorf's Deer and the American bison." Surely the student will gather from this that the Aurochs is a deer and that the Palæarctic bison is known as the Wapiti!

Mr. Beddard's concluding chapter is devoted to theoretical considerations. He warns the reader that the place where a group of animals is at present most abundant need not be the place of its origin. But he then puts forward a view, which will probably be the greatest surprise to naturalists to be found in the book, that the marsupials originated in Australia. Mr. Beddard seems led to this opinion by the consideration that, though some placental mammals have made their way into the Australian Region, the marsupials have not been exterminated by them. "The Marsupials," he writes, "have had the start in a country eminently suited to them, and have only been beaten in the struggle for existence in regions subsequently settled in by them and therefore perhaps less fit for their peculiar organisation." The older view, that the marsupials have found in Australia a "protected area" seems, however, to have far more to commend it to our acceptance. The extreme paucity of the Australian placental mammals as compared with the marsupials, and the divergence of the latter into groups of structure and habits corresponding with the various placental orders, point to the marsupials having had in Australia a tract preserved for their almost exclusive use. And the spread of the rabbit in Australia (which Mr. Beddard strangely brings forward in support of his view) surely shows what would happen to the marsupials were a large influx of placentals to take place. Perhaps, however, Mr. Beddard holds this opinion loosely, for in the section on the Polar Origin of Life, immediately following, he instances the marsupials as an ancient and primitive group, "once existing in great variety in Europe and North America . . . . the survivors having now been pushed into the furthest corner of the world—the Australian Continent."

A question of much interest touched at several points in Mr. Beddard's book is the possibility of a form of life originating independently in more than one place. As to this, he is disposed to adopt a "middle position." There can be no reasonable doubt that an identical variety may be developed independently in two places under similar conditions. And as, on any theory of evolution, the variety

must provide the starting point for all the higher classificatory groups, this admission may lead us a long way.

G. H. CARPENTER.

DAIRY BACTERIOLOGY.

DAIRY BACTERIOLOGY. A Short Manual for the Use of Students in Dairy Schools, Cheesemakers, and Farmers. By Dr. Ed. von Freudenreich. Translated by J. R. Ainsworth Davis. Pp. 115. London: Methuen & Co., 1895. Price 2s. 6d.

PASTEURISATION OF MILK AND CREAM FOR DIRECT CONSUMPTION. University of Wisconsin Agricultural Experiment Station, Bulletin no. 44. 8vo. Pp. 48. Madison, Wisconsin, 1895.

THERE is no room for dispute as to the advantage of a knowledge of at least the elements of bacteriology in the case of those who manage dairies. For long it has been a reproach to England that her dairy produce is inferior to that of Scotland, and, still more to that of Denmark and Sweden, of Switzerland and of France. This defect is partly due to the dense stupidity of the average English farmer, a stupidity that would have caused his ruin in any other occupation, and partly to the neglect of the pursuit of agriculture by successive Governments. Every county in England has now the opportunity of giving necessary instruction in dairywork, which, indeed, was one of the trades by special clause permitted to be taught under the Technical Instruction Acts. Many of the counties are taking advantage of their new opportunities, by instituting peripatetic dairy-schools; others are combining to aid or to establish agricultural colleges of more pretentious character. Dr. Freudenreich's book offers itself adroitly to the new dairymaid.

The first thirty-five pages give a brief but adequate account of bacteria, the manner of things they are, their habitat, life-history, and the methods of investigating them. The rest of the book is purely pertinent to the dairy. Milk from a healthy cow when it leaves the udder should be free from bacteria; but as it forms a cultivation medium almost ideal, it swarms with them in a few hours. The forms most commonly found and the differences between pathogenic and harmless bacteria are discussed sufficiently to impress upon readers the necessity for the most careful attention to the bacteriology of milk. Unfortunately, as the writer explains, there are no methods of complete sterilisation that do not destroy, to some extent, the delicate flavour of milk. On the other hand, the process of Pasteurisation is both practicable and of considerable advantage. As the writer shows, it destroys a certain number of germs and retards the development of all for a considerable time. But the one thing made plain, and for which alone the book should be in the hands of all connected with dairies, is that the germs of pathogenic bacteria can and should be prevented from ever gaining access to milk. This is possible only by the isolation of all cases of infectious diseases, and by the complete destruction of all contaminated things. This, no doubt, is a matter more for local and central sanitary authorities than for dairymen, but these must learn the dangers, and the resulting necessity for active co-operation with sanitary authorities. We have full confidence in recommending the book to all persons interested.

The valuable pamphlet from Wisconsin is a complete practical treatise on the nature, advantages, and methods of the process of Pasteurisation. In the process of sterilisation, milk must be subjected to the temperature of boiling water for a prolonged period or succession of periods. Such is the resisting action of spores and

the ease of contamination in the various processes, that even sterilised milk is rarely absolutely free from spores by the time it reaches the consumer. Moreover, the cost of the process is considerable; the constitution of the milk is altered, and the flavour is that of cooked milk. The process invented many years ago by Pasteur consists in the exposure of the milk for a short time to a temperature of about 140° Fahr. By this means, although spores are not destroyed, all the bacteria in the milk are destroyed, and consequently it keeps for a longer time than untreated milk. As the lactic acid bacteria do not form spores in milk, they are completely destroyed, and when the Pasteurised milk does begin to go wrong, it does not become disagreeable to the taste and useless for cooking purposes. Moreover, by Pasteur's process the fresh flavour is not destroyed, and the constitution of the milk is altered only slightly.

The "Bulletin" is, no doubt, too advanced for dairymaids, but we hope that it will reach the hands of all dairy teachers and technical instructors. And in especial we hope that it will reach the hands of the technical instruction committees and university authorities, who are subsidising and directing the agricultural departments of colleges and universities in England. For such persons are taking up the work of *teaching* agriculture vigorously enough, if not always wisely; but proper experimental work, such as this of the University of Wisconsin, is still sadly to seek in England.

Biology under the Essex County Council.

Biology Notes, no. 6, March, 1895, County of Essex Technical Instruction. County Technical Laboratories, Chelmsford.

This excellent little periodical is an indication that biology is being taught practically and intelligently under the provisions made by the Technical Instruction Committee of the Essex County Council. The number now before us contains some useful notes upon the practical aids to technical instruction wanted in the county. The writer urges the formation of a natural history museum in every town. We are by no means certain that this suggestion is practicable. A local museum soon degenerates into a mere collection of useless rubbish, unless a large annual income can be secured to provide for the maintenance of the collection by a skilled curator. It would be more practicable to have a central museum in the county, and to make arrangements for the issue to local schools and classes of typical loan collections illustrating the chief local minerals and fossils, the structure of plants and animals and so forth.

For another suggestion made by the same writer we have nothing but the highest praise. There should be attached to every elementary school in the county a small experimental garden. A plot of a few yards square is all the space required, and the necessary seeds, cuttings, and manures, with appropriate directions, could be issued at periodical intervals from the central laboratories at Chelmsford.

Among the features of special interest in the March number are well-arranged notes for "Practical Lessons in Botany." These should be of great use to the local teachers who are conducting classes under the auspices of the Council.

The Index to Flowering Plants.

On the 10th of October the fourth and last fasciculus of Mr. Daydon Jackson's colossal task, the "Index Kewensis Plantarum Phanerogamarum," was published. This includes *Psidium Gardnerianum* to

Zyzygium, and the "Addenda et emendanda graviora hactenus notata." There are also two title-pages, one for vol. i. and one for vol. ii., each bearing the date of 1895. Now, as fasciculi 1 and 2 came out in 1893, and fasciculus 3 in 1894, we cannot believe that a bibliographer of such reputation as Mr. Jackson could permit such a falsification by his publishers. We hope that in rebinding the book these new title-pages will be left at the end, and the proper title-pages kept in their proper positions. The preface also strikes us as not entirely consonant with the facts; it reiterates the statement that the work has been "carried out at the Herbarium of the Royal Gardens, Kew, with the aid of the staff of that establishment." We should be tired of hearing this, even if it were the whole truth.

We heartily congratulate Mr. Jackson and his staff on the accomplishment of their work, a work not only a monument of labour, but one so valuable as to be beyond price.

WITH the beginning of 1896 the bibliographic section of the *Zoologischer Anzeiger* will join forces with the Central Bureau, whose organisation we owe to Dr. H. H. Field, and will appear with the following title-page:—

BIBLIOGRAPHIA ZOOLOGICA

publiée par le Bureau International de Bibliographie, sous la rédaction de	herausgegeben vom International Bibliographischer Bureau, unter Redaktion von	published by the International Bibliographic Bureau, under the Editorship of

J. VICTOR CARUS,
Professor in Leipzig.

LEIPZIG
Wilh. Engelmann.

The annual subscription is fixed at fifteen shillings. Similar arrangements are nearly completed for a "Bibliographia Anatomica." These fortnightly publications are not intended to supplant existing Records, "The Zoological" or others, merely to furnish them with raw material ready sorted.

THAT excellent journal called *Insect Life*, published by the Agricultural Department of the United States, has been discontinued. The *American Naturalist* in an outspoken note on the matter, comments severely on this false economy on the part of an administration which has up to the present time taken the lead in economic entomology. The investigation into the lives of noxious insects is one of the most important that a Government can undertake, as it concerns the immediate welfare of thousands, and its neglect may lead to serious disaster.

WE have received the first two parts of *The West Indian Home Builder*, "a monthly magazine, devoted to the interests of West Indian Homes, and to developing West Indian Resources. The official organ of the Minor Industries Profit-Sharing Company, Limited. Subscription, 5s. per annum." 8vo. Barbados, W.I.

MESSRS. CASSELL send us the first part, price 6d., of a new monthly issue of Sir Robert Ball's "Story of the Heavens." With this part is presented a clear chart of the northern constellations. The edition, which will be completed in eighteen parts, is said to be revised.

OBITUARY.

CHARLES VALENTINE RILEY.

BORN SEPTEMBER 18, 1843. DIED SEPTEMBER 14, 1895.

THE man of science and the practical cultivator may well unite in mourning the death, through a lamentable cycling accident, of this prince of economic entomologists. Though his life-work was almost entirely done in America, Riley was English by birth—a native of London. Educated at Chelsea, Dieppe, and Bonn, he emigrated to the United States in 1860 and settled on a farm in Illinois. The practical experience thus gained was of the highest importance when he came later on to apply scientific principles to agricultural questions. In his early days in America he worked as a journalist and took part in the War of Secession. In 1868, he was appointed State Entomologist of Missouri, and the nine annual reports issued while he held this post mark an epoch in the economic study of insects. Like his subsequent writings, these reports are characterised by scientific accuracy coupled with clear and popular exposition; and while of special value to the farmer, fruit-grower, and forester, they abound with observations of interest to the pure naturalist. In 1877, Riley was appointed Chief of the U.S. Entomological Commission, and a year later Entomologist to the Department of Agriculture at Washington. This post he resigned somewhat quickly, but was re-appointed to it in 1881. He then organised the Division of Entomology, from which has issued an invaluable series of publications on the application of entomology to practical ends. Riley will be specially remembered for his researches on Phylloxera, and his successful use of the natural enemies of insect-destroyers of crops for waging against them an exterminating warfare. The introduction of the ladybird *Vedalia* from Australia to California to prey upon the previously-introduced coccid *Icerya* was one of the most notable examples of this. Besides his economic work, Riley acted as curator of insects in the U.S. National Museum, and edited the *American Entomologist*. In June of last year he resigned his posts through failing health and an impression that he could work more effectively if free from the trammels of office. Regret will be universal that the labours of his well-earned leisure have been brought to so untimely an end.

G. H. C.

JOHN ELLOR TAYLOR.

BORN SEPTEMBER 23, 1835. DIED SEPTEMBER 30, 1895.

DR. TAYLOR was born at Levenshulme, near Manchester, and was the son of a foreman in a cotton factory. He began life in the engineers' shop of the London and North Western Railway at

Crewe, and in his spare time studied Latin and Greek and the rudiments of science. Removing to Manchester, he contributed to some local paper, and his articles afterwards formed his first book. He adopted the profession of journalist, and was appointed editor of the *People's Journal*, Norwich, about 1860, and made the paper a great success. In 1872, he was appointed Curator of the Ipswich Museum on the death of Mr. George Knights. The museum, once an educational institute of considerable importance, had become somewhat effete, but under Taylor's rule it rapidly gained ground, and became one of the leading museums in the kingdom. Taylor's science lectures attracted numbers of hearers, and he did much to popularise his favourite subject of geology. His skill with the blackboard was remarkable, and he was also successful in modelling and colouring fish. But perhaps Dr. Taylor will be best known by his *Science Gossip*, a popular natural history journal which had an immediate and wide circulation. This was started in 1866, and is now continued under the editorship of Mr. J. T. Carrington. He was the author also of numerous popular handbooks, the best known of which are "British Fossils," "Half-Hours in the Green Lanes," and "Half-Hours at the Seaside." His last public appearance was at the Ipswich meeting of the British Association last September.

We are indebted to a sympathetic article by F. W. W. in the *East Anglian Daily Times* for the greater part of our information.

Moritz Willkomm, whose death has recently been announced, was born in 1821 at Herwigsdorf, in Saxony. At the age of 20 he went to the University of Leipzig to study medicine and natural science. In 1844 he began his travels in the Spanish peninsula, the flora of which he thoroughly investigated; it was this that formed the subject of his thesis when he was admitted into the Philosophical Faculty of Leipzig University in 1852. In the following years he published "Icones et Descriptiones Plantarum novarum criticarum et variarum Europæ Austro-occidentalis præcipue Hispaniæ" (1852–6). Having taught for some time at Leipzig, and afterwards at Tharandt, he was, in 1868, called to the University of Dorpat, and in 1873 to the Chair of Botany in the German University at Prague, in which city he also became Director of the Botanical Gardens. Among his other works may be mentioned "Illustrationes Floræ Hispaniæ insularumque Balearicum" (1881–92) and the most useful "Prodromus Floræ Hispaniæ" (1861–80) with its supplement in 1893. In the last-mentioned undertaking he was associated with I. Lange. Willkomm also published valuable works dealing with German and Austrian forestry, as well as a hand-book to the plants of Germany, Austria, and Switzerland.

Professor Heinrich Adolf Bardeleben, the eminent surgeon, died at Berlin on September 25, aged seventy-six. He was born at Frankfort-on-the-Oder in 1819, and was educated for medicine at

Berlin, Heidelberg, and Paris. He became Prosector (1843) and afterwards Professor at Giessen, and in 1849 became Professor at Greifswald. In 1868, he went to Berlin University as Professor of Surgery. He saw service in the field in 1866 and 1870, and was created surgeon-general at the close of the Franco-Prussian War. Bardeleben's best-known work was "Lehrbuch der Chirurgie und Operationslehre," 1852, of which the eighth edition appeared in 1879–82.

Paul Howard Macgillivray, well-known for his researches on Australian Polyzoa, died at Bendigo, Victoria, on July 8 last. He was a son of John Macgillivray, the son of the more famous William. His contributions to the history of the Polyzoa began in 1859, and, altogether he produced some two dozen papers on the subject in the *Trans. R. Society Victoria* and other publications. He was an active member of the Field Naturalists' Club of Victoria, and looked after the interests of the Bendigo Science Society, the Bendigo School of Mines, and other institutions. The *Victorian Naturalist* states that his fellow-townsmen propose to erect a memorial to mark their sense of his usefulness to the town and to science.

Dr. E. von Rebeur-Paschwitz, who died October 1, 1895, at the early age of 34, modified the horizontal pendulum of Zöllner, and converted it into an instrument admirably adapted for recording the movements of the ground, and especially those which are due to strong and distant earthquakes. His work in this department of seismology is of great and permanent value. Few men have laboured so earnestly and with such success, even when they have not been hampered, as he was, by continual illness, weakness, and suffering.

The deaths are also announced of:—Thomas James Slatter, the well-known collector of Gloucestershire fossils, on August 1, at Evesham, aged sixty-one; Angelo Manzoni, the well-known geologist and palæontologist, at Ravenna, on July 14; Dr. Ernst de Sury, Professor of Medical Jurisprudence at Basle, on August 20; Dr. Rira, botanist and African explorer, at Rome, on July 24; Dr. F. Miescher, Professor of Zoology at Basle University, at Davos, on August 26, at the age of fifty-one; Dr. H. Senoner, the geologist, of Vienna, on August 30 last. Dr. Demetrius Brandza, Professor of Botany and Director of the Botanical Institute at Bucharest, who died on August 15, at the age of forty-eight, was the author of "Histoire botanique et thérapeutique des Gentianacées employées en Médecine" and a Prodromus of the Flora of Roumania (1879–83).

The *Kew Bulletin* for September records the death, at Madras, on August 17, of Mr. Andrew Jamieson, Curator of the gardens and parks at Ootacamund, Milgiris. Formerly a member of the gardening staff at Kew, Mr. Jamieson was appointed to Ootacamund in 1868.

NEWS OF UNIVERSITIES, MUSEUMS, AND SOCIETIES.

THE following appointments have recently been made:—Mr. F. B. Stead, of King's College, Cambridge, as naturalist to carry on the fishery investigations at the Marine Biological Association at Plymouth; Mr. T. V. Hodgson, as director's assistant at the same place; Bernard H. Woodward, as Curator of the Museum, Perth, Western Australia; Mr. C. French, jun., to the Entomological Branch of the Department of Agriculture in Victoria; Dr. R. Metzner, to the chair of Physiology at Barcelona; Dr. Hans Lenk, as Professor of Geology to Erlangen University; Dr. E. Ihne, to the Technical High School of Darmstadt; Dr. Haecker, as Assistant Professor in Zoology to the University of Freiburg-in-Breisgau; Dr. Strahl, as Professor and Director of the Anatomical Institute in Giessen; Dr. Hermann Credner, as full Professor of Historical Geology and Palæontology to Leipzig University; Dr. Dalla-Torre, as Assistant-Professor of Zoology to the University of Innsbruck; Dr. Max Verworn, as Professor of Physiology at Jena; Dr. Otto Jaekel as Prof.-Extraordinarius of Geology, in Berlin. Dr. Albert Fleischmann is undertaking the duties of Professor Selenka at Erlangen during the professor's temporary absence; Dr. Selenka is nominated honorary Professor at Munich. Dr. Duclaux has been elected President of the Pasteur Institute.

The following news comes from America:—Professor E. J. Chapman has resigned the chair of Geology and Mineralogy in Toronto University. Professor F. L. Washburn has gone to the Oregon State University. Professor F. W. Rane has resigned the chair of Agriculture at the University of West Virginia to take that of the New Hampshire College of Agriculture. Professor G. E. Morrow has accepted the Presidency of the Oklahama Agricultural College at Stillwater. Professor E. W. Doran has accepted the Presidency of Ozark College at Greenfield, Missouri. Professor H. J. Waters has been elected Director of the Missouri Experiment Station. Professor F. B. Mumford has been appointed Professor of Agriculture in the Missouri State University; Dr. Walter B. Rankin and Dr. C. F. W. McClure, Professors of Biology in Princeton College; H. B. Kümmel, Assistant-Geologist in the Geological Survey of New Jersey (Trenton); Dr. G. P. Grimsley, of Columbus, Ohio, as Professor of Geology and Natural History in Washburn College, Topeka, Kansas; Dr. W. S. Strong, of the University of Colorado, as Professor of Geology and Physics in Bates College; W. D. Matthew, of Columbia College, as Assistant in Vertebrate Palæontology in the American Museum of Natural History.

We note the following botanical appointments:—Mr. T. H. Stephen, formerly of Kew, and lately Curator of the Lal Bagh Botanic Gardens, Bangalore, Mysore, to be Superintendent of the Public Gardens at Nagpur, Central Provinces, in succession to the late Mr. J. R. Ward, who died last January; F. Reinitzer, of Prague, to be Prof.-Extraordinarius at Graz. In America, the *Botanical Gazette* records the appointments of Dr. R. H. True to be instructor in pharmacognostical botany at the Wisconsin University; Dr. W. A. Setchell to a professorship in botany in the California University; and Dr. J. E. Humphrey to be lecturer in botany at the Johns Hopkins University.

SOME friends of Mr. Joseph Thomson being desirous of erecting a memorial monument over his grave at Thornhill, a subscription has been opened for that

purpose. Those who wish to join in this tribute to the memory of the African traveller may send their subscriptions to J. G. Bartholomew, hon. sec., Royal Scottish Geographical Society, Queen Street, Edinburgh.

THE late Professor Babington has left his botanical collections, and Miss Saul her collection of shells, to the University of Cambridge.

THE report of the committee to consider the question of the desirability of the compulsory retirement of professors serving under the Crown has been published. The committee is of the opinion that when a professor reaches sixty-five years the head of the college should report to the Government concerning the efficiency of the teaching. If this be satisfactory, the superannuation of the professor should not take place till he has reached seventy, but at that age retirement should be compulsory. Heads of colleges, should the college be likely to suffer from a retirement at seventy, should be allowed to remain until seventy-five.

DURING the meeting of the International Zoological Congress, the University of Utrecht conferred its degree upon Professor Weismann, Sir William Flower, and Professor Milne Edwards.

THE University of New York has received from Miss Helen Gould sufficient funds to endow two scholarships of 5,000 dols. each. The Massachusetts Institute of Technology receives 10,000 dols. under the will of the late Benjamin P. Cheney.

THE programme of the Union University, Schenectady, New York, includes courses on mineralogy and lithology, general, economic, historical, field, and areal geology, independent research and palæontology. Especial efforts are being made to promote the field-work of the classes by excursions in the district this autumn and next spring. The library is rapidly growing, and the specimens in the museum have been identified, labelled, and arranged. We are glad to hear that "a collection of recent shells has been selected which is used for preliminary training in palæontology." The study of zoology as a whole is one to be encouraged, rather than the absurd restrictions to "fossil" or "recent" so common even in the present day.

FROM the Annual Report of the Gordon Technical College at Geelong, we gather that the field-work is in a flourishing condition, while the work of the museum has progressed steadily, despite the shortness of funds consequent on general depression. Everything in the museum has now been placed under glass, and the building was opened to the public in January last. Messrs. H. E. Hill and J. Hammerton are the Honorary Curators. The Field Naturalists' Club has handed its collection of minerals over to the Gordon College, and there is now only one museum in Geelong. A new quarterly publication was started in August last called *The Wombat*, and in it are papers by D. Le Souëf on "Victorian Macropodidæ," and by Sidney Johnson on "Some Native (Victorian) Woods." This publication, which is at present disfigured by advertisements in every page, will, it is hoped, gradually assume sufficient importance to confine these matters to special pages.

SYDNEY University has been obliged to decline the bequest of Sir William Macleay, for the purpose of founding a chair of bacteriology, owing to the conditions attached. The money will therefore go, says *Science*, to the Linnean Society of New South Wales, to support a bacteriologist who will carry on experiments and take pupils.

THE synopsis of evening demonstrations and lectures to be delivered this session at the Birkbeck Institution by Mr. G. F. Harris, has been issued. The subjects are elementary, advanced, honours, and applied geology, mineralogy, and elementary and advanced physiography.

TOYNBEE HALL, Whitechapel, has made an advance in its good work of education. The various committees, including that for the University Extension Lectures, have combined to form a single Education Committee. Among the lectures for the winter session the following are likely to interest our readers:—"Life and its Functions," by P. Chalmers Mitchell, Fridays, at 8 p.m.; Practical Biology, in connection with the above, by Miss K. Hall, Wednesdays, at 8 p.m.; Practical Physiology, by S. Rowland, Mondays, at 8 p.m.; Stratigraphical Geology, by Miss Raisin, Tuesdays, at 7.45 p.m.; Botany, by G. May, Thursdays, at 7.30 p.m.; "The Physiology of Every-day Life," by D. Walsh, Sundays, at 11.30 a.m. In addition, Professor Michael Foster will inaugurate a series of popular lectures on biological subjects; among the lecturers will be Professors Victor Horsley and Gotch. The meetings of the Natural History Society are held on the first Monday of every month, at 8 p.m. The good work which this Society does was well exemplified at the Conversazione on September 28 by an interesting series of exhibits from the Lake district, the Channel Islands, North Wales, Epping Forest, and even places so distant as the Forum at Rome. It is a pity to have to read at the end of all this that "the Education Committee, composed chiefly of students, experiences great difficulty every year in raising sufficient funds to meet expenses, in spite of the fact that all the teaching, except the Extension Lectures, is freely given by the class-takers."

ACCORDING to the *Daily Chronicle* a new school of science, art, and technology, which has been erected by the Dover Corporation at a cost of £10,000, was opened on September 19. It adjoins the municipal buildings, with which it has connection, and is a notable addition to the architecture of the town. The school is lighted throughout by electricity.

AT the beginning of October the Mayor of Brighton laid the foundation stone of a technical institute in Brighton. The sum of £26,000 is to be spent upon it, and it will accommodate the 1,100 scholars which the Corporation is said to be now training in various schools in the town.

THE *Brighton Herald* informs us that it has been resolved by the Library, Museum, and Fine Arts Committee of Brighton to expend £115 instead of £100, on the new Illustrated Catalogues of the Museum of Birds. Mr. Lomax had written that not only had the letterpress been revised and enriched with notes made by Mr. Booth himself, but full descriptions were given of the additional cases which the collection had received, and an account of Mr. Booth's work in building up the "Booth Bird Museum" was prefixed. A portrait of Mr. Booth has been added and about fifteen illustrations.

Plans and contract drawings have been submitted for the extension of the Library, Museum, and Art Gallery. These plans the Committee has approved, and it has instructed the surveyor to prepare detailed specifications and quantities, upon which tenders may be invited for the performance of the work by special contract. The scheme, estimated to cost £22,800, has already been approved, and the drawings are now exhibited in the Council Chamber.

THE Committee of the Sunday Society has fixed the date of the fourth "Museum Sunday" for Sunday, November 3.

WE learn from the *Tasmanian Mail* of August 17 that several important additions have just been made to the Tasmanian Museum, which are calculated to materially add to the popularity of that attractive institution. In the Australian room a fine collection of the auriferous and argentiferous rocks of Queensland has been displayed. The contributing fields and districts embrace Charters Towers, Gympie, Gladstone, Glastonbury, Rockhampton, Warwick, Stanthorpe, and Moreton. Altogether there are more than 2,000 specimens, and to local students of mineralogy they will prove very valuable. A noticeable improvement in the

arrangement of this room is the fixing of the shelves in the centre cases in a sloping instead of a horizontal position. The contents of the shelves (the larger fossils) can be thus seen to much greater advantage. Downstairs in the general room a very valuable collection of native implements and dresses from the Fly River, New Guinea, presented by the Rev. James Chalmers, of the London Missionary Society, has been placed in a position worthy its importance. Highly-finished specimens of drums, pipes, wooden shields, head ornaments, fishing baskets, adzes, bone daggers, armlets, etc., are included and, together with specimens previously obtained from the south-east end of New Guinea, these form the best collection of New Guinea ethnological specimens in the colonies, saving only that in the Sydney Museum. The stone axes are particularly fine and well finished, weighing from 10 lb. to 12 lb.

A REUTER'S telegram states that the Cape Government has appointed a Geological Commission, consisting of the Hon. Mr. Merriman, Dr. Muir, Dr. Gill, Mr. Stewart, and Mr. Currey. The work of the Commission will extend over a considerable period, and the results are expected to be of the utmost service to Cape Colony.

THE annual report of the Director-General of the Geological Survey has just reached us. We rejoice to hear officially that the topography of the old series of ordnance one-inch maps in the South of England is imperfect and inadequate, and it has been decided to engrave the results of the Drift Survey on the New Series of maps. We hope Surrey is considered by the Ordnance Survey to be in this district. Sheet 11 of the General Geological Map (four miles to the inch) will shortly be issued, and sheet 9 has been completed and is in the hands of the engraver. The account of the middle and upper oolitic rocks by Mr. H. B. Woodward is in type and is promised for this year.

The record of field work done during the year is a very full one, but interesting discoveries are few. Among them we notice the remarkable crush-breccias of the Isle of Man, which have now been worked out by Mr. Lamplugh. Mr. Strahan has found a bed of white oolitic rock forty feet thick in the middle of the main limestone in the South Wales Coalfield. In the note on work done in Permian districts there is a pleasing reference to the assistance rendered to the Survey by an outsider, Mr. J. D. Kendall. A long array of results in the geology of Scotland is set down, but as they are mostly minutiæ, we must refer our readers to the report. A brief summary of progress in Ireland is given, but this does not amount to much, as the director is hampered by a reduced vote, and field-work has had to be abandoned. One point, however, of great importance is set forth, and is that Sir A. Geikie is satisfied that, Mr. Kilroe has proved that the Croagh Patrick Quartzite and its southern equivalent does not belong to Dalradian, but is of Llandovery age. It is thus necessary to colour a large area as Silurian instead of Metamorphic.

We have already noticed that the Museum of Practical Geology is now open every week-day instead of being closed on Fridays as heretofore.

WE learn from the *American Geologist* that Mr. Max Krahmann, editor of the *Zeitschrift für praktische Geologie*, announces that hereafter that journal will be published in Berlin (Charlottenburg, Schillerstrasse 22), and that in connection with it he will establish a "Bureau for Practical Geology," where maps, books, and advice concerning economic geology can be obtained.

THE Perthshire Society of Natural Science has lately been devoting itself to the natural history of the banks of the Tay, and the full account of these researches is embodied in a series of papers published in the *Transactions* (vol. ii., part 2). The present series of papers deals with Physiography, by Dr. H. R. Mill and James Coates; Stratigraphical and Physical Geology, by James Coates; Superficial

Deposits, by the Rev. F. Smith; Flowering Plants, by the late Buchanan White; Mollusca, by H. Coates; Birds, by Colonel Drummond Hay; Mammalia, by Buchanan White; and Chemistry of the Tay Water, by Dr. Andrew Thomson. This series of local papers is of considerable value and interest, and we shall be glad to see a second series dealing with the groups not yet investigated

The Perthshire Society's Museum, which is in Tay Street, Perth, contains representative collections of the local fauna, flora, and petrology of Perthshire, as well as an index collection of general natural science. The latter is kept entirely distinct from the former. The new museum building will be opened by Sir William Flower on Friday, November 29, when, if we may judge of the energy of those engaged, everything will be completely arranged.

THE *Transactions* and Annual Report of the Manchester Microscopical Society for 1894 presents us with a portrait of Professor Weiss, the president, whose address on "The Chromosomes of the Nucleus" is printed in full. The Society numbers 217. It suffered a serious loss in the death of Professor Milnes Marshall, its president for seven years. To commemorate his name a subscription list was opened, and £33 pounds collected, of which £20 was sent to the Owens College Committee, and the remainder spent on books for the Society's library. There is a balance in hand of £15 in the treasurer's report. Besides Dr. Weiss's address, there is a paper by Dr. Moss on "The Value of the Radula as an aid to Classification," in which the author shows that the radula alone cannot be of sufficient value for the purpose. There is, also, among other papers, an interesting account of a visit to Cumbrae and those grand old field-naturalists, Mr. and Mrs. David Robertson.

LAST month we briefly noted that Mr. Mansel-Pleydell had been the recipient of a piece of silver plate in consideration of his services to Dorsetshire natural history. We find that the occasion was the more interesting as it marked the twentieth anniversary of the foundation of the Dorset Natural History and Antiquarian Club, which was due in great part to Mr. Mansel-Pleydell's exertions. The plate took the form of a flower vase in delicate allusion to Mr. Mansel-Pleydell's last work, "The Flora of Dorset."

THE accounts of the Norfolk and Norwich Naturalists' Society are before us. They show, in common with those of other similar societies, how much good work can be done with a little money. The new number of the *Transactions* (vol. vi., part 1) is full of interesting papers, notably one on Neolithic Man in Thetford district by W. G. Clarke. Mr. Southwell has some notes on additions to the Norwich Museum in 1894, the principal of which were a variety of *Caprimulgus europæus*, a Scandinavian form of the Dipper (*Cinclus melanogaster*), a Richard's Pipit (*Anthus ricardi*) among local birds; a Rose Perch (*Scorpæna dactyloptera*)from Yarmouth, an addition to the fishes of the East Coast, and two large Breams (*Abramis brama*) from the river Wensum. Mr. F. Danby Palmer has collected some valuable notes on old-time Yarmouth naturalists.

A SUBSCRIPTION list has been opened in Bristol for the purchase of Mr. Nockler's collection of Jenner relics in connection with the introduction of vaccination.

A BRONZE bust of Robert Brown, the botanist, has been presented by Miss Paton to the Montrose Town Council. It has been placed in a niche in the house where Brown was born in 1773.

IN the *Proceedings* of the Birmingham Natural History Society (vol. ix. (2), 1895), Mr. W. Jerome Harrison has published a Bibliography of Midland Glacialogy, including over 150 papers, ranging from 1811–1894, which should be instrumental in stemming the flood of glacial literature.

CORRESPONDENCE.

The Mounting of Wet Preparations for Museums.

In his interesting paper, "Morphology at the National Museum," recently published in your pages, Mr. Ridewood alludes to a difficulty experienced in labelling dissections intended to be preserved in spirit.

Such a difficulty I also encountered when recently mounting some preparations for the Index Collection of Invertebrates, now in course of formation at Leicester, and, not feeling satisfied with the methods in vogue, either at the National Museum or at Oxford, I finally adopted the expedient of substituting thin silver wire, coated with vermilion, for the usual paper pointers.

The oil colour should be used (mixed with a little medium to facilitate drying) and applied to the wire while the latter is rigidly extended. In attaching a pointer to its label, one of the extremities is bent at right angles and passed through a perforation in a thin strip of paper which is fastened to the back of the label with coaguline. The bent head of the pointer is thus firmly held between the two pieces of paper, leaving the rest of the wire projecting behind. When labelling, the pointer may either be thrust into the tissue, or, where this cannot be done, the judicious use of a few drops of photoxylin will suffice to hold the label in any desired position.

This method is specially useful when dealing with specimens which project considerably beyond the glass plate to which they are affixed, since the labels can be brought to a level with the surface of the preparation. When the object is a flat one (*e.g.*, the nerve-chain of *Astacus*), I prefer to attach the labels to the glass plate with coaguline. In this case, one extremity of the pointer rests on the tissue, the other is held between the label and the glass.

The advantages of such a pointer seem to me to be twofold; first, its rigidity, and consequent power of supporting the label in any position, and, secondly, its uniform thickness, having in this respect an advantage over paper. I may mention that, when the wire has been properly coated, I have not detected any perceptible change in colour after an immersion of some months. However, should contact with the metal tend in time to produce deterioration in this respect, it would not be difficult, I imagine, to substitute a rigid, non-metallic substance for the wire here recommended.

I note that Mr. Ridewood urges the transparency of paper when immersed in spirit as a reason for attaching the labels to the outside of the preparation jar. I do not myself think that this transparency interferes to any serious extent with the legibility of the print, added to which greater uniformity in appearance is secured, to say nothing of the facilities offered for indicating the various parts of the dissection by *direct contact* with the extremity of the pointer; to my mind a point of no little importance.

Leicester Museum. F. R. Rowley.

NOTICE.

To Contributors.—*All communications to be addressed to the* Editor *of* Natural Science, *at* 22, St. Andrew Street, Holborn Circus, London, E.C. *Correspondence and notes intended for any particular month should be sent in not later than the* 10*th of the preceding month.*

To the Trade.—Natural Science *is published on the* 25*th of each month; all advertisements should be in the Publishers' hands not later than the* 20*th.*

The "Challenger" Number.—*In reply to enquiries, we remind our readers that, although the* First *edition of this ran out of print immediately, there are still some copies of the* Second *edition to be obtained at the usual price*—One Shilling. *No more will now be printed, so orders should be sent at once.*